The REFINER
AND NATURAL GASOLINE MANUFACTURER

Saving money with High Vacuum

The 12-inch Elliott Booster Ejector illustrated is serving a 450-barrel batch system lubricating oil still using Somerset crude. The ejector is actually producing an absolute pressure of 5 mm., giving greatly increased yield and a saving in steam.

Elliott Ejectors, designed for the particular conditions of individual stills, are demonstrating the remarkable economies possible with high vacuum distillation. Our experience in the application of high vacuum equipment it at your service.

Besides high vacuum booster ejectors, Elliott Company can also furnish complete vacuum equipment for lubricating oil stills.

ELLIOTT COMPANY
PITTSBURGH, PA.
General Offices **JEANNETTE, PA.**
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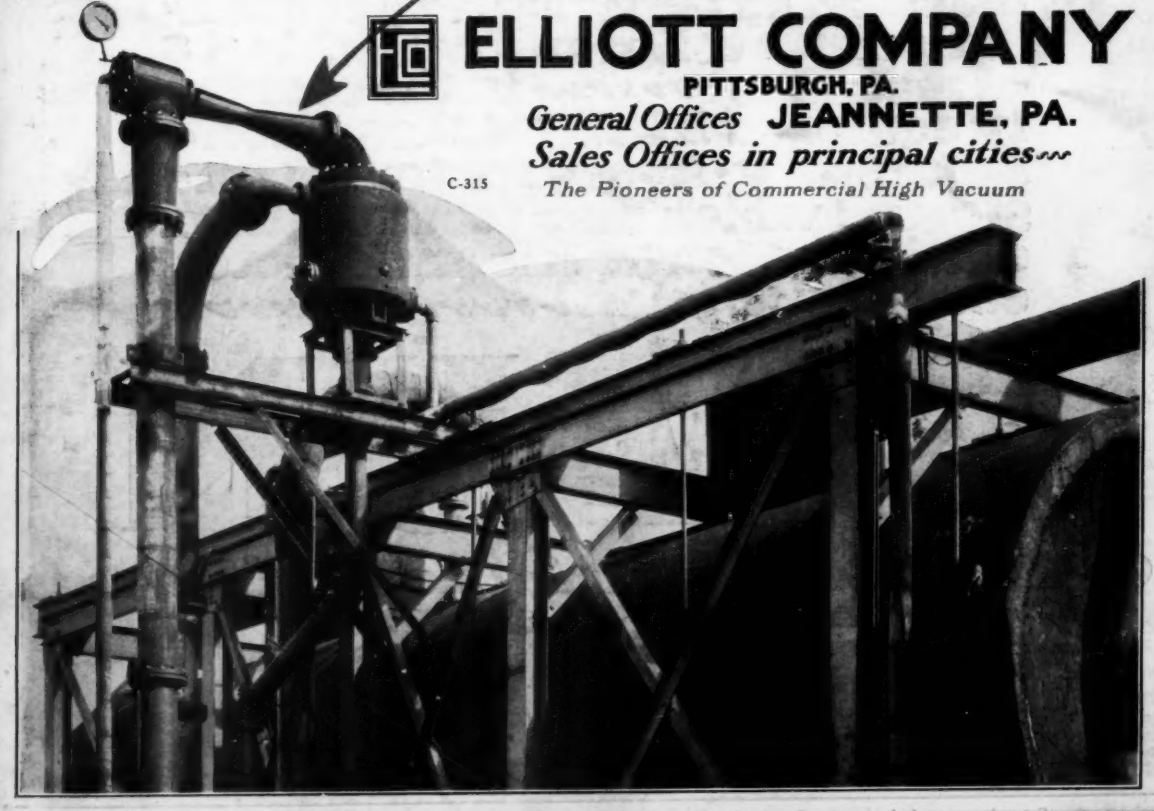
C-315
The Pioneers of Commercial High Vacuum



RESEARCH

The design of all BRAUN apparatus has a *background* of exhaustive research—including practical experience, experimentation in design and *careful* tests of materials in the completely equipped BRAUN Research-laboratory · Every factor is considered which may produce greater efficiency, longer life and greater ease of operation

BRAUN

C·F·Braun & Co·Manufacturing Mechanical Engineers

ALHAMBRA CALIFORNIA

TULSA · NEW YORK · DALLAS

Entered as second class matter June 16th, 1923, at the Postoffice at Houston, Texas, under the Act of March 3, 1879.

Ball Bearings Eliminate Friction

Sensitive, Accurate, Reliable

NEILAN BALL BEARING LIQUID LEVEL CONTROLLERS

The ball bearing construction of the Neilan Liquid Level Controller eliminates practically all friction and because of sensitive, responsive action, the full power of the float is delivered to the valve, which quickly responds to the slightest variation in the liquid level.

Ball thrust bearings in the float chamber fully compensate for any end thrust on the shaft, and an outboard ball bearing supported in a malleable iron or cast steel yoke carries the load of the shaft, relieving the load on the stuffing box and prolonging the life of the packing. The shaft cannot bind or stick. The stuffing box stays tight, and practically all friction, binding and distortion are eliminated by the ball bearing and yoke construction.

Neilan controllers can be furnished with rotary stem valves, sliding stem valves with lubricated yoke guides, or standard type valves, as desired. All balanced lever valves have balanced valves with auxiliary discs which produce gradual opening and closing, and precise regulation under widely varying load conditions. Neilan valves do not chatter or hunt when working close to the seats.

Made in cast iron and cast steel for working pressures up to 750 lbs. All valve stems and pins are made of stainless steel to prevent corrosion, sticking and binding. Complete descriptive literature mailed on request.

NEILAN, SCHUMACHER & CO.

641-651 Santa Fe Avenue, Los Angeles, California

Branch:
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P. H. Wilkinson, Mgr.

NEILAN

Representatives:
Maintenance Engineering Corp.,
2000 Harrington Street,
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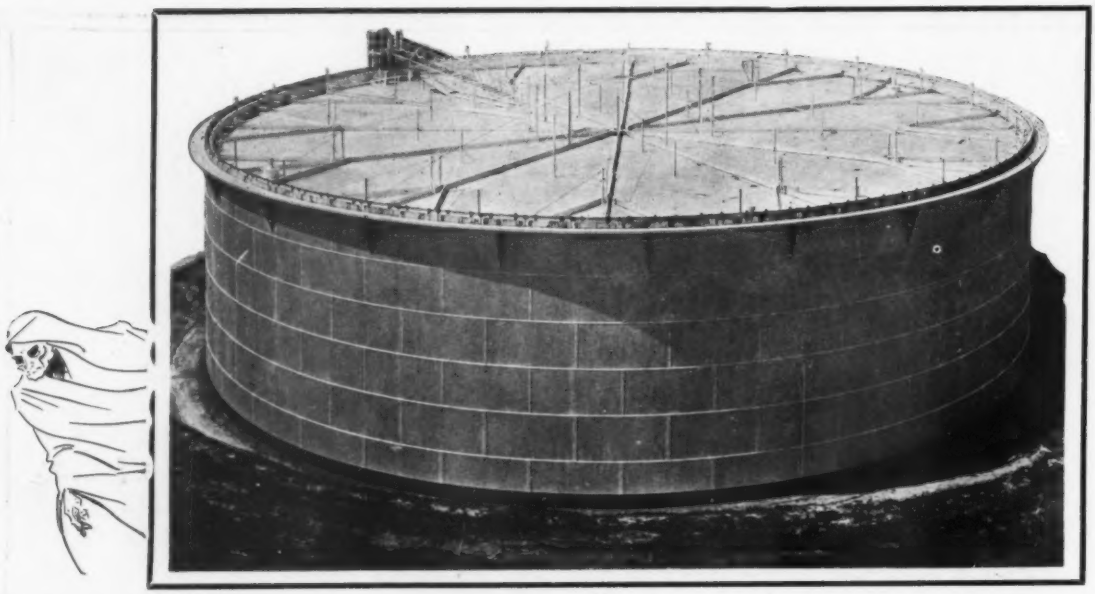
"You Can Be Sure of Neilan Products"



*E*vaporation losses won't haunt you . . . . If you store your oil under WIGGINS ROOFS

IT is not pleasant for anyone responsible for the storage or handling of oil to think of the tremendous losses of the most valuable fractions, caused by evaporation.

But you can escape this haunting thought of evaporation losses. Tanks equipped with Wiggins Roofs practically eliminate this loss. The two types of Wiggins Roofs meet every condition of oil storage—the Floating Roof for working storage and the Breather for standing storage.

The Floating Roof

The Wiggins Floating Roof has achieved its marked success through its ability to keep air away from the oil in a tank. Since it floats on the surface of the oil there is absolutely no air space under the roof whether the amount of oil in the tank is large or small.

Evaporation cannot take place unless air is allowed to come in contact with the oil. Even in so-called gas-tight tanks air saturated with oil vapor passes out the vent when the tank is being filled or when the temperature rises and fresh air rushes in when these conditions are reversed. Obviously this loss is eliminated by a Wiggins Floating Roof. Splash-over losses during filling are also eliminated through the provision made for releasing air which enters with the oil in the filling line. Such air passes out through vents in the roof after giving up any entrained oil.

The Breather

The new Wiggins Breather provides a gastight roof which flexes up and down as the vapor expands and contracts. This movement accommodates an increase in volume of the vapor of approximately one-third on an 80,000 gallon tank which is normally ample to prevent any loss whatever. Relief valves are provided for both the upper and lower positions of the roof.

This roof has been thoroughly demonstrated in service and is available for either new or old tanks. Its simple construction fits it for tanks in which oil is stored for long periods.

Fire Hazard Also Eliminated

The same features of the Wiggins Roofs which prevent evaporation losses also eliminate the fire hazard. Fire cannot reach the oil under a Wiggins Roof.

Send for this illustrated booklet

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WIGGINS FLOATING ROOF FOR WORKING STORAGE BREATHER ROOFS FOR STANDING STORAGE

R 10-Gray

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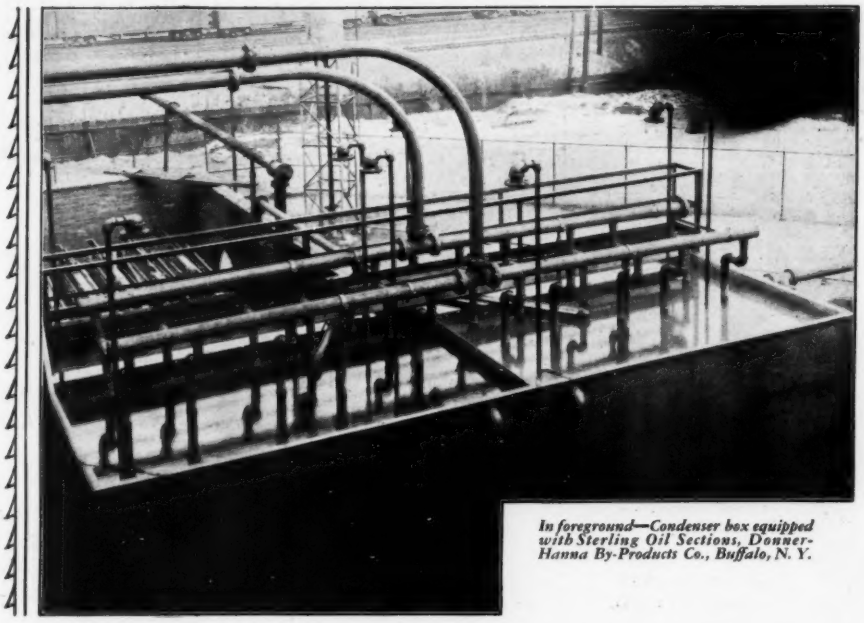
For complete condensation of highly volatile products, use . . .

STERLING Oil Sections



In foreground—Condenser box equipped with Sterling Oil Sections, Donner-Hanna By-Products Co., Buffalo, N. Y.

THERE is probably no more acute condition of condensing service than that which occurs in the condensing and cooling of the highly volatile products developed in a coke by-product plant.

The above illustration shows condenser box equipped with STERLING Sections at the Donner-Hanna By-Products Co., Buffalo, N. Y.

Here the STERLING Condensing surface is shown in submerged application, having displaced a battery of atmospheric water film coils similar to those shown in the back ground; and while the cut shows the battery applied to the light oil stills, the plant is similarly equipped on the C. P. Benzol stills.

The necessity for complete condensation in order that the non-condensable gases may be properly exhausted through the atmospheric vents indicated is imperative.

In this installation of Donner-Hanna, as elsewhere where STERLING Condensing surface is used in this practice, there is indicated an increased capacity output and a corresponding equivalent decrease in the amount of water required.

Send for Chart Data and Catalog of STERLING Oil Sections

AMERICAN RADIATOR COMPANY

Industrial Division No. D

Factory: Springfield, Ill.

40 West 40th Street NEW YORK | 816 South Michigan Avenue CHICAGO | 935 Kennedy Bldg. TULSA | 1214 Quinby Bldg. LOS ANGELES

These Distributors stock ADAMANT in 100 lb., 250 lb., and 400 lb. containers. Distributors are listed under state and city, with states arranged alphabetically.

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Applying an ADAMANT-ADACHROME Mixture with The ADAMANT Gun. This inexpensive equipment costs only $25.00, but it saves thousands of dollars in refractory repair costs for the refinery.

What $25.00 Can Save You

SPEND $25.00 for The ADAMANT Gun—and in purchase price it makes the first big saving for you.

Use The ADAMANT Gun for applying ADAMANT - ADACHROME Mixtures or other refractory surfacing materials on your fire brick construction, and the real big savings begin.

Speedily and thoroughly, The ADAMANT Gun surfaces your brickwork with ADAMANT-ADACHROME coatings that fill up all brick pores, cracks and open joints. They preserve the plumb, uniform surface of the brickwork, while retarding the adhesion of clinker and protecting the brickwork from the action of slags and other destructive elements.

The ADAMANT Gun helps you to keep your furnace linings serviceable for much longer periods. It frequently defers a rebricking and saves its cost many times over in refractory repair expense.

Send for the new booklets describing The ADAMANT *Gun and The* ADAMANT - ADACHROME *Mixtures.*

BOTFIELD REFRACTORIES CO.
783 S. Swanson St.,
Philadelphia, Pa.

For A Long Furnace Run, Use The ADAMANT *Gun*

ADAMANT
FIRE BRICK CEMENT

Whenever You Use a Fire Brick, Use ADAMANT, *The Original High Temperature Cement*

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Why We Say:

"Better Built for Longer Service"

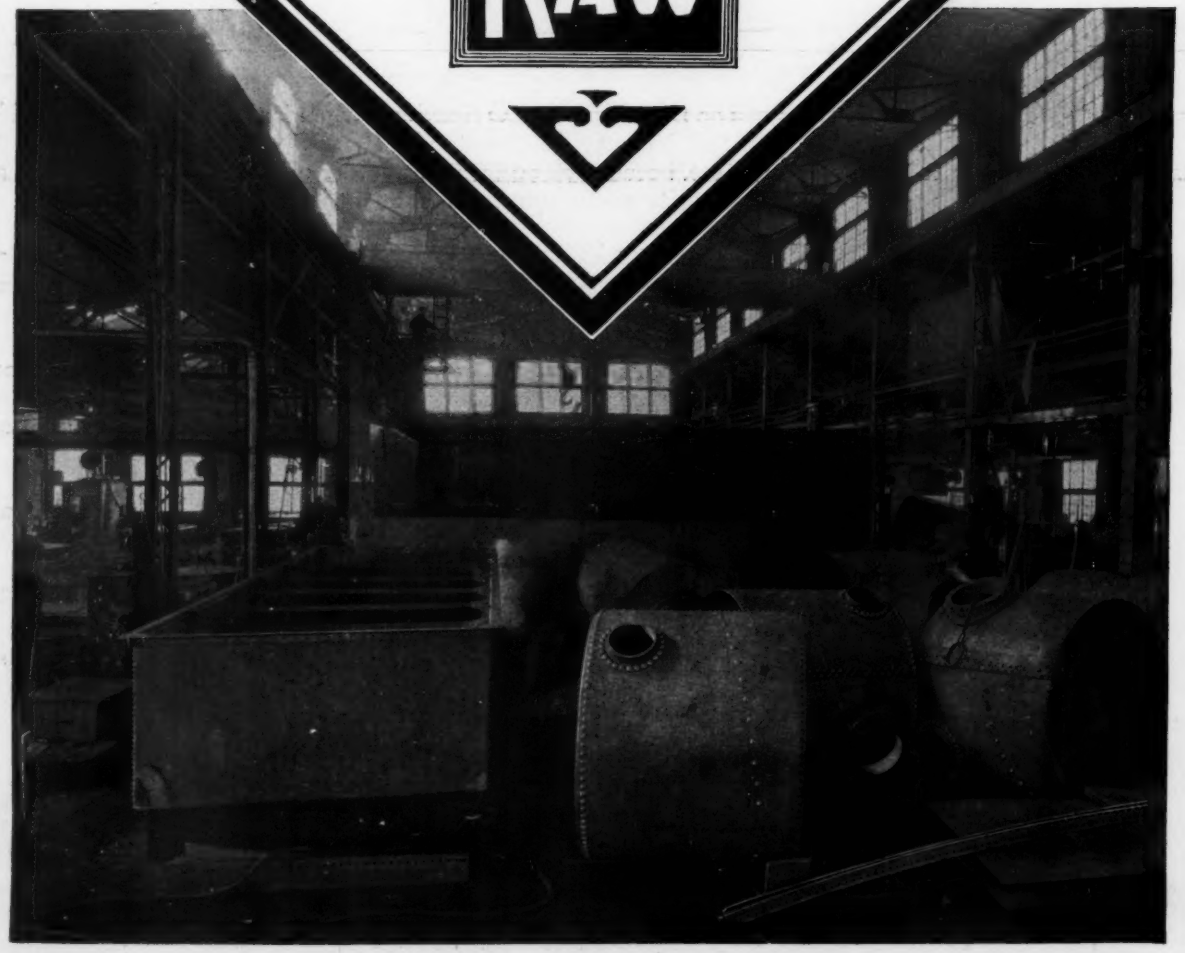
The statement that KAW Refining equipment is "Better Built for Longer Service" is backed by actual facts that prove it true. Year after year, day in and day out KAW Products serve refining men at lowest possible upkeep cost. We are willing that you should examine any piece of KAW equipment now in service and let the results guide you in your selection of your next refining needs.

Write, wire or phone for prices on Storage, Horizontal and Rundown Tanks, Condenser Boxes, Bubble Towers, Stacks, Stills, Etc.

KAW STEEL CONSTRUCTION CO.

General Office and Plant: First and Walker Ave., Kansas City, Kans.

KAW



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A Flame-Proof Across-The-Line Starting Switch

The Type ZO Starting Switch is rated from 1/6 to 5 HP at 110 volts and from 1/6 to 10 HP at 220, 440 and 550 volts.

The EC&M Type ZO Starting Switch is rapidly being adopted by the oil industry as the standard device for starting small A. C. motors, because **all contacts are under oil** and it eliminates fire hazards so far as the starting equipment is concerned.

The Type ZO Switch provides push-button control, overload, phase-failure and no-voltage protection. A vapor-proof push button is supplied when specified.

The thermal overload device is of the expansion wire type, operating at such a low temperature that it never shows color. It can not burn out. Its contacts are under oil. **This is the only safe overload device to use where explosive vapors are present.**

The Type ZO is the ideal starting switch for use at oil refineries, bulk storage stations and other places where a flame-proof, weather-proof, fool-proof starter is required.

The Type ZO Starting Switch is approved and listed by the Underwriters' Laboratories of the National Board of Fire Underwriters.

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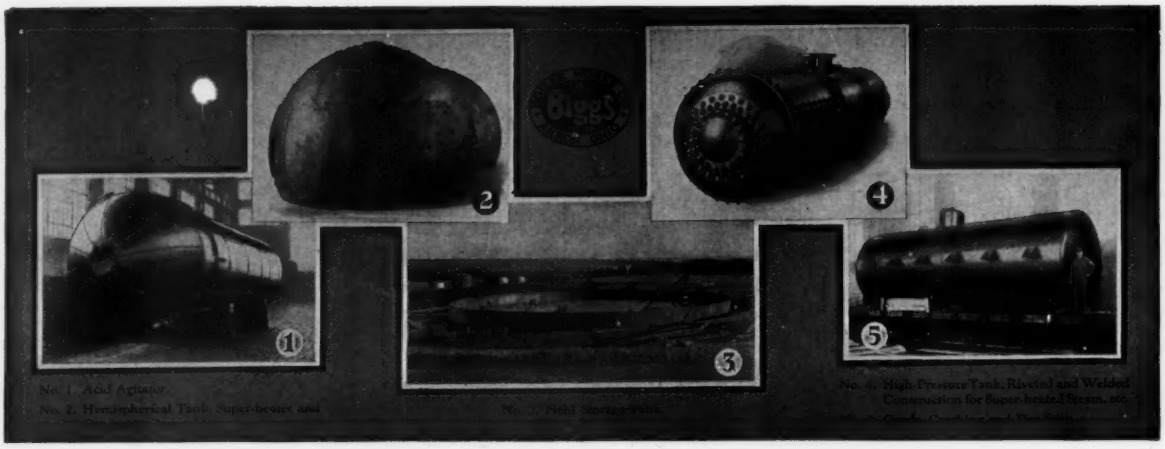

No. 1. Acid Agitator.
No. 2. Hemispherical Tank, Super-heater and
No. 4. High Pressure Tank, Riveted and Welded Construction for Super-heated Steam, etc.

Steel Plate Construction
Worthy of Your Complete Confidence

HAIR LINE accuracy in manufacture, express train speed in delivery and absolute dependability in performance have given Biggs steel plate equipment a reputation older than the oil industry itself.

It is backed by successful experience with field conditions and exceptional manufacturing facilities for the prompt production of special as well as standard equipment that keeps costs down and profits up in the face of severe operating conditions.

Biggs engineers, also, are always available for consultation and advice on heavy steel plate construction problems. Experienced Biggs field crews simplify the erection and installation of efficient, leak-proof tanks, stills and other oil country equipment anywhere, at any time.

"Tank Work by Biggs" means "Made Right—Always Tight." If you would like an accurate idea of the plant and equipment we have provided to serve you, mail the coupon below for our completely illustrated pamphlet, "*What Biggs Does and How,*" a picture tour of the mammoth Biggs plant at Akron.

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- Pressure Stills for Cracking Process
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THE BIGGS BOILER WORKS COMPANY

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TANKS AND GENERAL
STEEL PLATE WORK
for the Oil Industry

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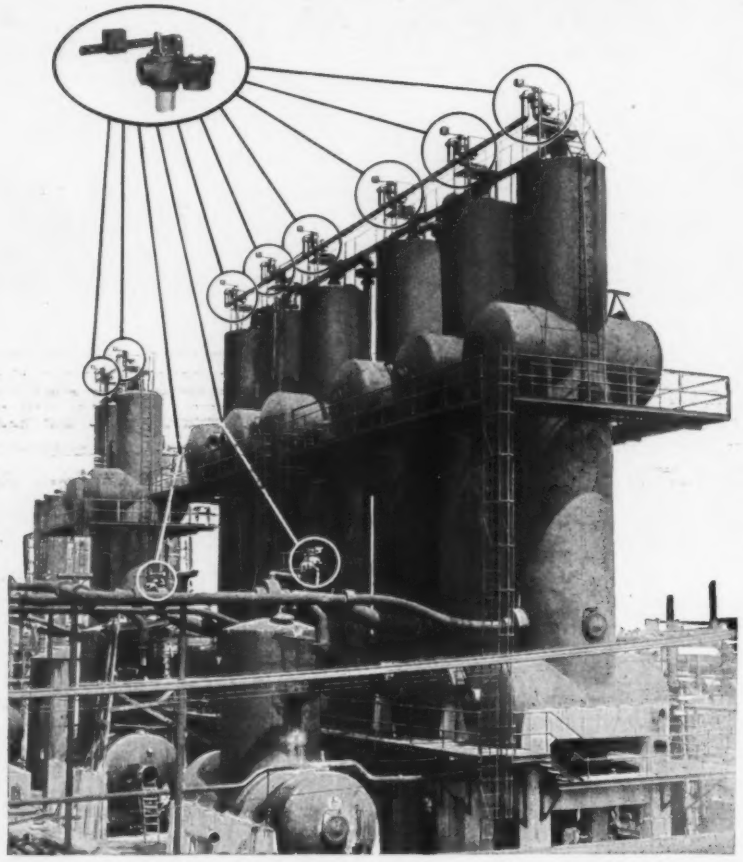
Modern Safety Valves for Modern Stills



A FEW years ago refiners *could put up* with old style still safety valves because conditions were not as severe as today.

Now, pipe stills and modern distillation apparatus demand something better.

For the past five years OCECO Still Safety Valves have been successfully meeting these modern conditions because in *design, material* and workmanship they have been *built* to meet them. Sizes up to 8 inches; pressures up to 30 pounds.

Send for catalog now. You will be interested also in Oceco Look Boxes and Automatic Tar Plugs.

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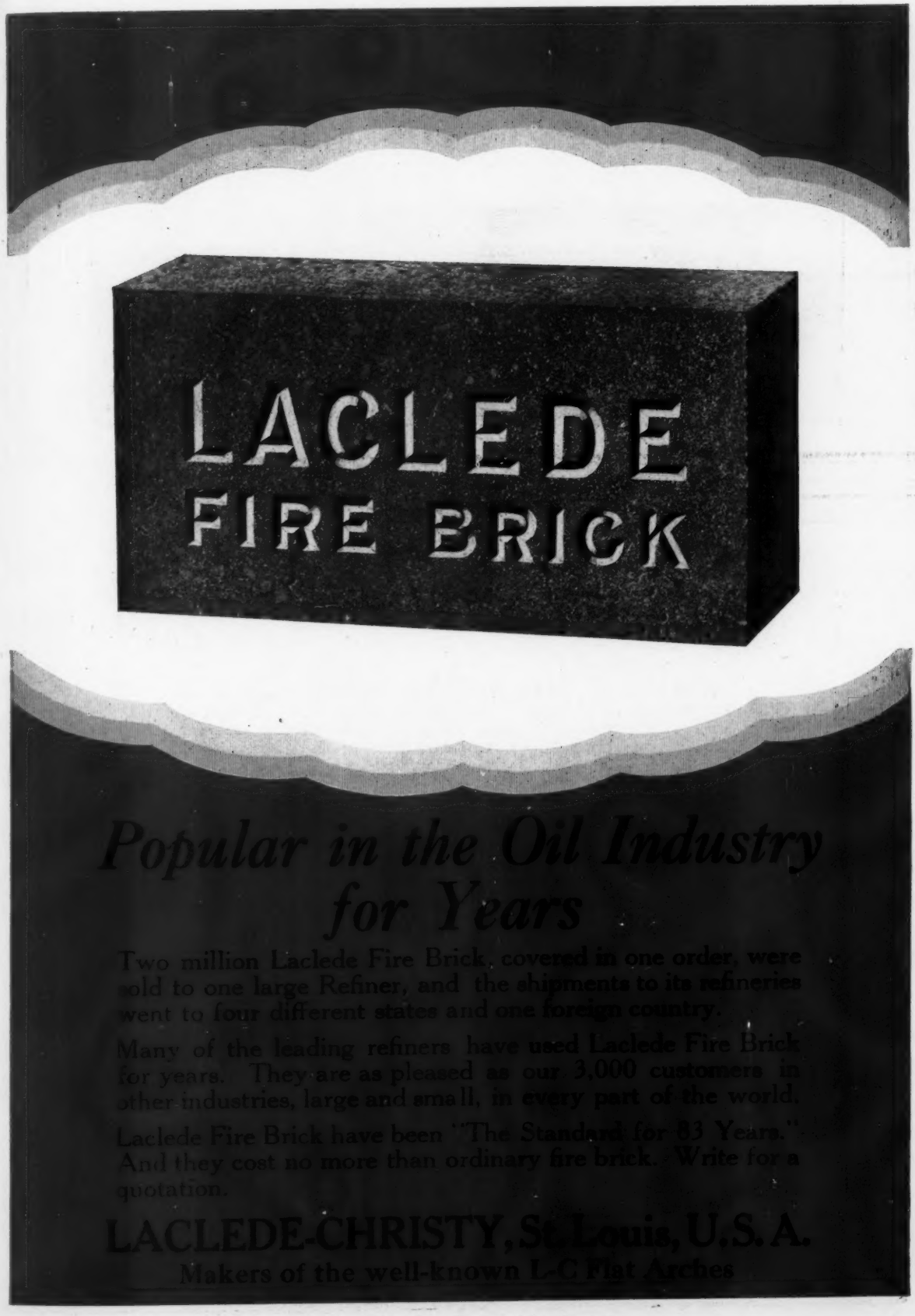

Popular in the Oil Industry for Years

Two million Laclede Fire Brick, covered in one order, were sold to one large Refiner, and the shipments to its refineries went to four different states and one foreign country.

Many of the leading refiners have used Laclede Fire Brick for years. They are as pleased as our 3,000 customers in other industries, large and small, in every part of the world.

Laclede Fire Brick have been "The Standard for 83 Years." And they cost no more than ordinary fire brick. Write for a quotation.

LACLEDE-CHRISTY, St. Louis, U.S.A.
Makers of the well-known L-C Flat Arches

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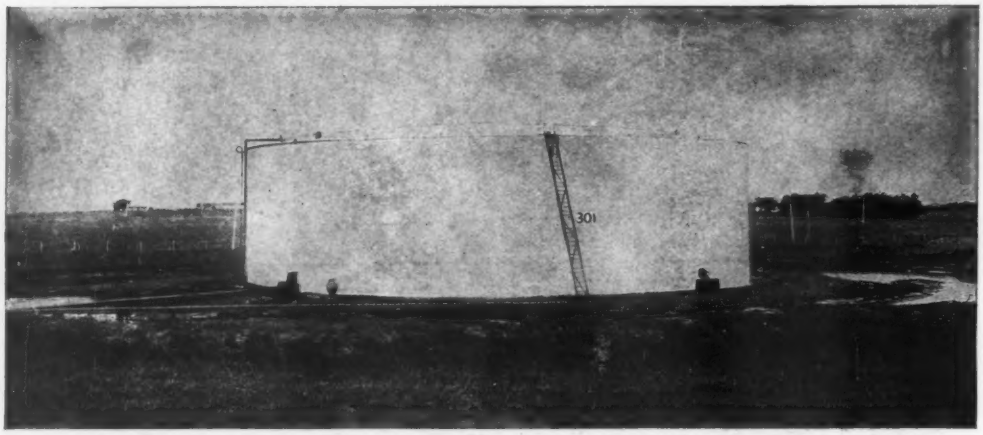

Save Gas and Protect Your Tanks *with*

COOK'S "SUPER GAS-PROOF" TANK PAINT

COLOR is the first consideration in painting oil storage tanks. Scientists have proved that light-colored tank paints will save an evaporation loss of many barrels annually. It is folly to waste oil when so much can be saved by the use of the right paint.

Our "Super Gas-Proof Tank Paint, White" is absolutely fume-proof and will not discolor. It has a satin-like texture which resists dirt and remains clean even after years of service. It is economical for even the largest surfaces. It may be applied with either brush or spray; and it covers solidly.

The Physical and Chemical Laboratories of the Cook Paint & Varnish Company have specialized in developing paints for the oil industry. Cook Service Men know your maintenance painting problem. An inquiry places you under no obligation

Five great factories and ten branches located in the heart of the mid-continent oil fields enable Cook's to give prompt service on your requirements.

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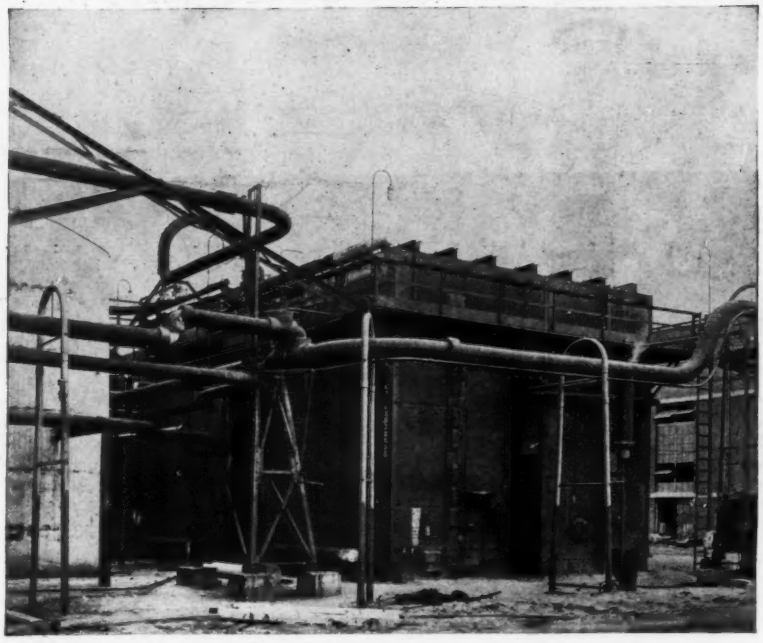


Fuel consumption less than 1¼% of the thruput

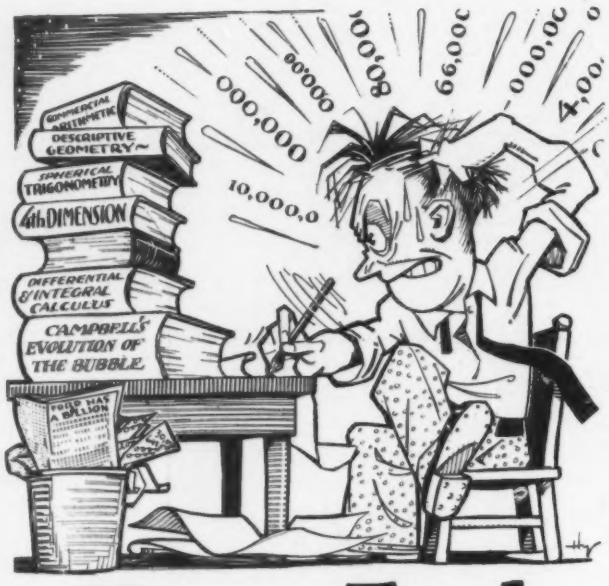
This is the record for several months made by the two Foster Tube Stills shown above, having a topping capacity of 8,000 barrels per day. These stills have been operated 25 per cent in excess of the rated capacity with entire satisfaction.

No matter what your oil-heating requirements, they can be economically performed with Foster Tube Stills. These stills, in connection with Foster Fractionating Towers, constitute the most efficient and compact units now available for oil refining.

FOSTER

FOSTER WHEELER CORPORATION
formerly Power Specialty Co. and Wheeler Condenser & Engineering Co.
165 Broadway, New York City
Branches in principal cities.

The TUBE STILLS with the protected surface



Henry Ford has a Billion *but* CAMPBELL has *Billions!!*

Imagine

billions and billions——yes even trillions of tiny bubbles — all working simultaneously—each with its individual film of oil—extracting gasoline from the gas that forms the bubbles! In a Campbell Oil-Froth Absorber all the space is filled with this super-abundance of froth.

Our Catalog tells the whole story. Ask for it.

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Consulting—Designing—Construction
Natural Gas Engineer

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CAMPBELL
OIL FROTH
absorber

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SAVE the waste

Refinery Rundown Tank Losses equal 1.8% storage losses of light products equal 2.5% according to— U. S. Bureau of Mines

The recovery of vapors from Rundown and Storage tanks eliminates waste and is profitable because of the high gravity gasoline content of the vapors.

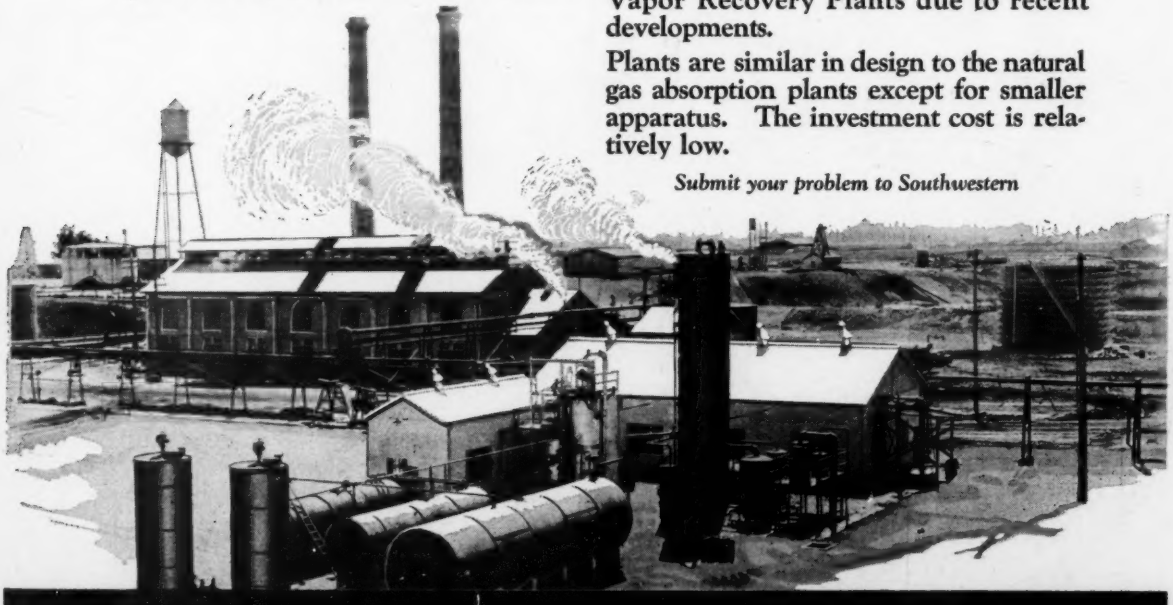
Southwestern Vapor Recovery Plants have proven successful. They pay for themselves in a short time in nearly every case.

In the recovery of refinery vapors, a much more stable gasoline than previously possible, can be produced in Southwestern Vapor Recovery Plants due to recent developments.

Plants are similar in design to the natural gas absorption plants except for smaller apparatus. The investment cost is relatively low.

Submit your problem to Southwestern

Southwestern Vapor Recovery Plant in a California Refinery



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FISHER
in the field

In the gas line where an accurate vacuum must be maintained, the Fisher Vacuum Regulators will perform dependably. There is a type to meet your requirements.

Type 86—An ultra-sensitive, all-metal self-enclosed vacuum regulator. Will hold positive down to ½-inch of mercury on inlet side. Type 88—Will regulate any vacuum on inlet side. If desired can carry 3 lbs. pressure on inlet side and vacuum on outlet. Type 87—Casing head self-enclosed combination Back Pressure and Vacuum Regulator. Eliminates friction due to dirt, sand, snow or sleet.

The Fisher Gas Pressure Regulator is another piece of precision equipment that has won the confidence of the Oil Industry through consistent performance.

The great variety of types of pressure regulators enables you to choose just the regulator for your particular service. In addition to various ranges of pressures, which give us an opportunity of serving you, we have a large variety of combinations of expanded outlet sizes. Write for illustrated catalogue of the entire Fisher line.

To the left is shown a picture of the Fisher Ultra-Sensitive Vacuum Regulator Type 86, holding vacuum of 5 inches on an oil and gas well.

THE FISHER GOVERNOR CO.

1319 Fisher Building

MARSHALLTOWN, IOWA, U. S. A.

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Griscom-Russell

Heat Transfer Apparatus

G-R Sectional Condensers

The sectional arrangement of this condenser provides many special operating advantages. Sections can be added to or removed to meet varying capacity requirements. The complete unit is readily transported and re-assembled if necessary to meet changing plant conditions. Inspection and cleaning are greatly facilitated by removable tube bundles.

There are many additional advantages in the special design and construction of the G-R Sectional Condenser. Its special features are concisely described in leaflet which will be sent on request.

THE GRISCOM-RUSSELL CO.
285 Madison Ave., New York

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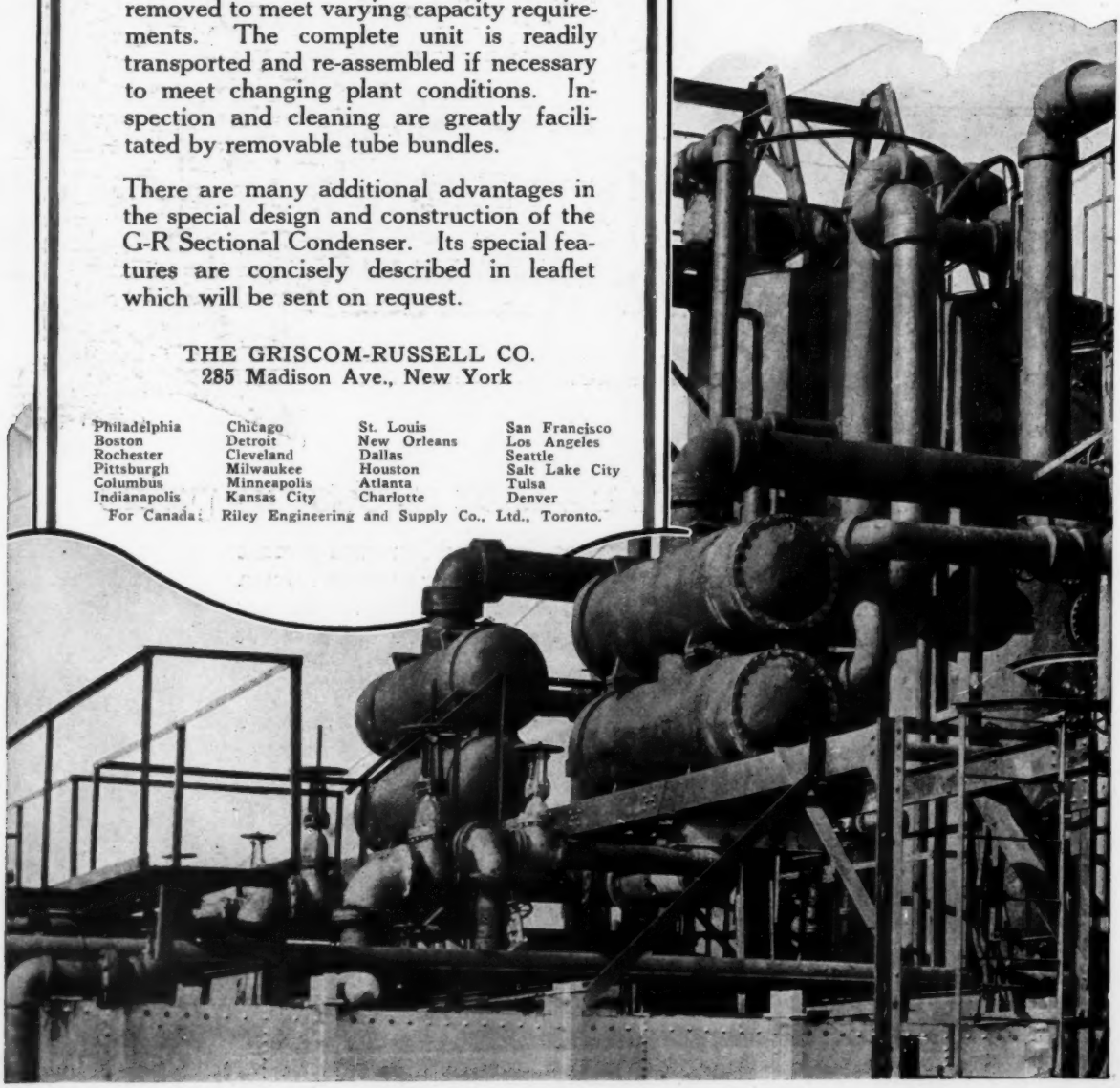
OIL HEATERS
LEVEL CONTROLLERS



TRANSITE

CORRUGATED ASBESTOS Roofing and Siding

A cracking coil furnace with roof and curtain walls of Transite Corrugated Asbestos Roofing and Siding.

Fireproof sheathing that needs no paint

TRANSITE is asbestos fibre and Portland cement united under tremendous hydraulic pressure to form a solid, homogeneous sheet that can neither burn nor rust and that has unusual tensile strength. Throughout the oil industry it is saving paint bills and minimizing risk where fire threatens.

Buildings, sheds, housings and fire barriers are readily constructed of Transite. In case they are torn down, the Transite can be removed and used elsewhere. Its permanence spells economy in meeting oil industry requirements.

JOHNS-MANVILLE CORPORATION, MADISON AVENUE AT 41ST STREET, NEW YORK
BRANCHES IN ALL LARGE CITIES. For Canada: CANADIAN JOHNS-MANVILLE CO., Ltd. TORONTO

Asbestos and its allied products
INSULATION
BRAKE LININGS
ROOFINGS
PACKINGS
CEMENTS
FIRE PREVENTION PRODUCTS

JOHNS-MANVILLE

Oil Industry Department

Mention Where You Saw the Advertisement

Banish Leaks In Refining Industry with MERCO NORDSTROM VALVES

Won't Stick Won't Leak

Operation with high temperatures.
Operate under high or low pressure.
Equally satisfactory on vacuum lines.
No foreign matter can pass the film of lubricant.
No joints or grooves in which foreign matter can lodge.

Each valve tapped at mill tested, insuring absolute shut-off within its marked working pressures.
Bottom entirely enclosed.
Made in different types of metals to handle every kind of gas, liquid or slime.

Quarter turn opens or closes valve.
Non-corrosive metallic diaphragm interposed between plug and packing.
Plug held in its seat at all times. Turning of lubricant screw produces pressure up to 2000 lbs. per sq. in. on plug.
No mechanical adjustments to open or unseat the plug.

Complete catalogue describing valves in detail will be forwarded upon request.

MERCO NORDSTROM VALVE CO.
SUBSIDIARY OF THE MERRILL COMPANY

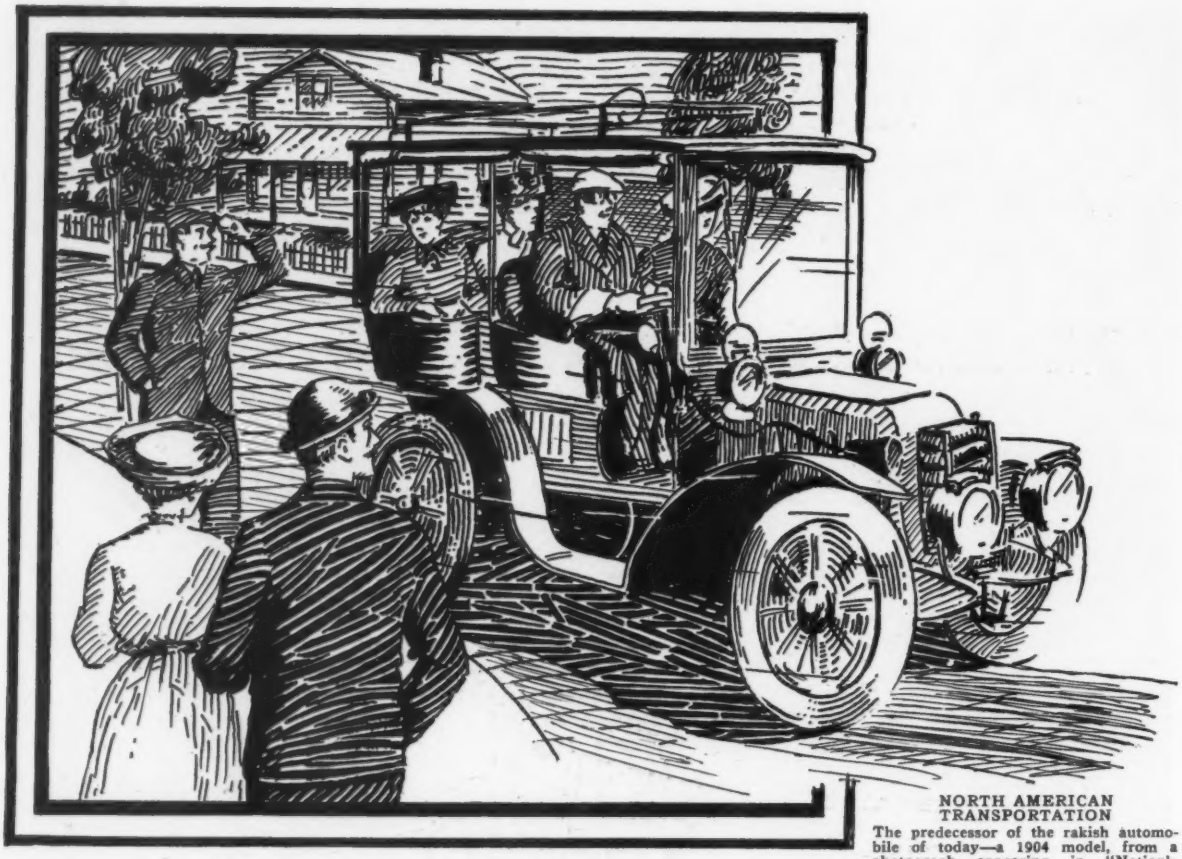
Engineers— *Manufacturers*

San Francisco, 121 Second St.
Chicago, Peoples Gas Building
Cleveland, Ohio, 325 Engineers Building
Western Factory: Oakland, California

MERCO

New York, 11 W. 42nd St.
Houston, 1311 Petroleum Bldg.
New Orleans, 1501 Masonic Temple Bldg.
Eastern Factory: Belleville, New Jersey

AGENCIES IN PRINCIPAL CITIES



NORTH AMERICAN TRANSPORTATION
The predecessor of the rakish automobile of today—a 1904 model, from a photograph appearing in "Nation's Business."

From Four to Four Million in 30 Years

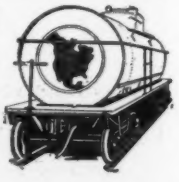
Only 35 years have passed since Charles E. Duryea, in Springfield, Mass., gave the first practical American car its initial trial. It demonstrated its right to be called an automobile by propelling itself into the wall of the barn.

In 1905 George Heath won the first Vanderbilt Cup Race by driving at the startling rate of 52 miles an hour. Recently, in Florida, Major Seagrave drove a Mystery Sunbeam at the rate of 203 miles an hour.

Automobile production 30 years ago was four cars. Last year it was 4,500,000 cars.

Never has there been so phenomenal a development. Nothing indicates more clearly the evolution of transportation. To move passengers and freight from one point to another expeditiously and economically is one of the major considerations of the day.

In the matter of certain types of freight this consideration has led inevitably to freight car *leasing*. The shipper leasing North American tank, refrigerator or Palace poultry cars, exercises all the advantages of *ownership*. For the life of the lease (which may be any period from one trip to five years) the equipment is *his*. Yet he has no heavy capital investment. He pays no interest or taxes and has no obsolescence charges. In periods of seasonal depression he simply adapts his leases to his requirements.



In addition to its leasing services North American offers many practical auxiliary services. These include car repairing, the furnishing of repair parts from stock, and structural steel plate work. Full details will be mailed on request.

NORTH AMERICAN CAR CORPORATION, Executive Offices, Chicago, Ill.

Car Shops: Chicago, Ill., Coffeyville, Kans., Tulsa, Okla., North Judson, Ind. Bulk Oil Warehouses, Chicago, Ill., Tulsa, Okla.
Export Terminal: New Orleans, La., Galveston, Texas

North American
CAR LEASING SERVICE

Mention Where You Saw the Advertisement

"NATIONAL"
HAMMER-WELDED

REACTION CHAMBERS

NATIONAL Reaction Chambers are made by hammer-welding, throughout, including the welding on of heads and nozzles.

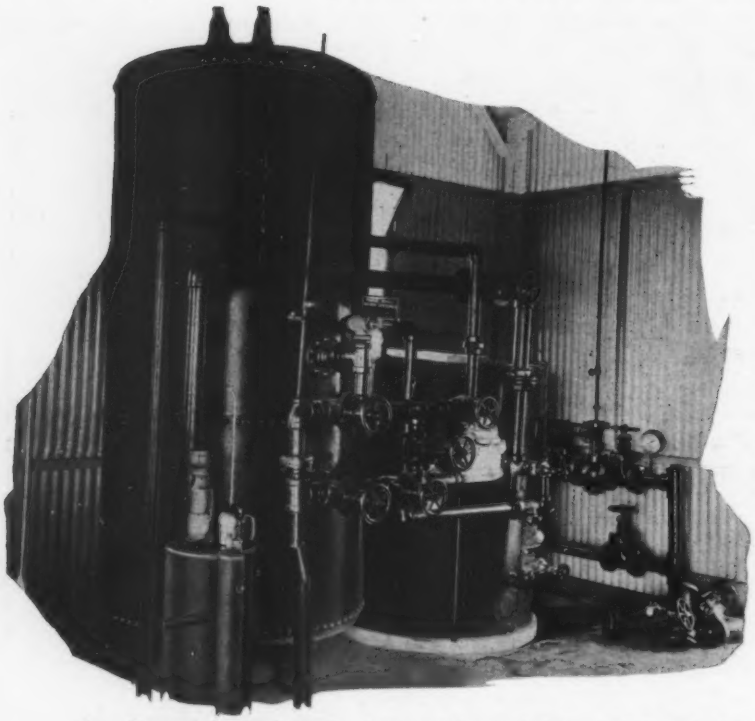
A type of construction is thus obtained which is free from all interior projections, such as overlapped seams and rivet heads. The factor of leakage and its attendant dangers in oil refinery work is also eliminated.

As any size or design that is practical to make or ship can be fabricated practically complete at the mill, considerable assembling work at point of erection may be dispensed with. The value of these advantages will be readily apparent to the oil refinery engineer or executive.

National Tube Company has ample facilities for executing a wide range of special designs in Oil Refinery Vessels, and our engineers will be glad to cooperate with you and offer suggestions in this work at any time. Our Bulletin No. 13 contains a fully illustrated chapter on High Pressure Vessels. Write today for your copy—sent upon request.

NATIONAL TUBE COMPANY, PITTSBURGH, PA.

District Sales Offices in The Larger Cities



A Typical Paige-Jones Rapid Rate Upflow Zeolite Water Softener Installation. This more economical type of zeolite water softener was originated and developed by Paige-Jones.

ATTENTION

Operators of Oil, Gas and Diesel Engines

What is the best cylinder head insurance? Taking lime and magnesia salts out of the make-up cooling water. Lime-magnesia salts form these dangerous scale deposits.

The method? Install the Paige-Jones Rapid Rate Upflow Zeolite Water Softener.

The cost? Low enough so that by eliminating one engine failure alone with its accompanying loss of production and labor charges would go far toward offsetting it.

The time? Now!

The Experience of One Operator

"Since installing these softeners (the Paige-Jones) . . . we have practically eliminated all cracked engine heads and it is very uncommon to find scale in our engine jackets."

Shaffer Oil and Refining Co., Tulsa, Oklahoma

Send For This Interesting Story on the Value of Softened Water.

Paige & Jones Chemical Co., Inc.

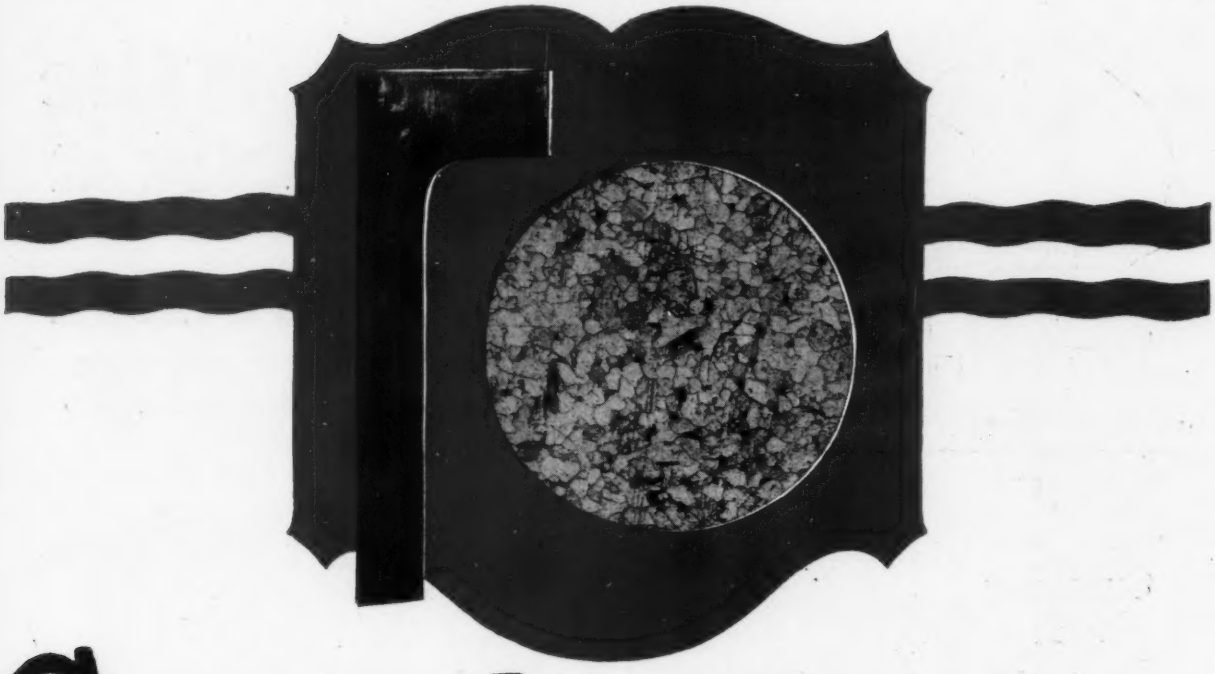
General Sales Office, Technical Dept. and Works,
HAMMOND, INDIANA
Executive Office: 461 FOURTH AVE., NEW YORK
Offices in Principal Cities

Be assured of Paige-Jones economies

PAIGE-JONES WATER SOFTENING

ZEOLITE AND LIME SODA SOFTENERS · PRESSURE SAND FILTERS ·
BOILER FEED WATER TREATMENTS · HOUSEHOLD WATER SOFTENERS ·

Mention Where You Saw the Advertisement



Contributions to the Art

SHOWN here is another Midwest contribution to the development of piping for higher pressures and higher temperatures.

Midwest has perfected a process for rolling Van Stone, Sargol and Midwest Joint laps to practically any required thickness. Physical tests and microphotographs (the one shown here is typical) of these laps indicate that the properties of the metal are improved by this process.

This is additional evidence that the Midwest shops at St. Louis and Los Angeles are not hampered by the traditions of piping design and fabrication. The policy is to improve and simplify wherever possible.

Perhaps you also can profitably use this Midwest piping service. When you have a piping problem or require fabricated piping, get in touch with the office nearest you.

MIDWEST PIPING & SUPPLY COMPANY

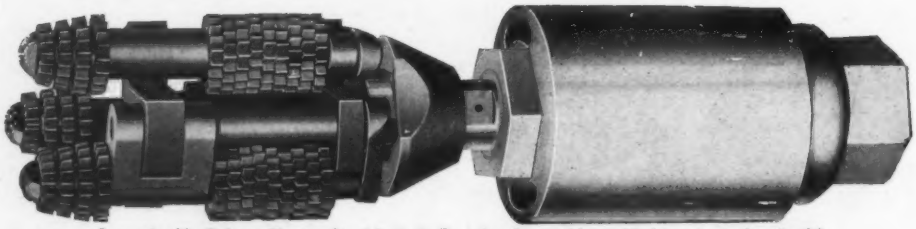
Plants at Los Angeles and St. Louis

Offices:	Los Angeles	Tulsa	St. Louis	Chicago
	520 Anderson St.	805 Mayo Bldg.	1450 S. Second St.	208 S. LaSalle St.

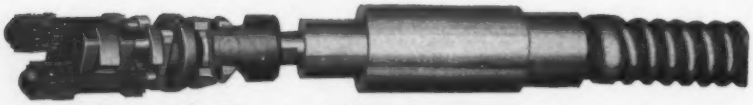
MIDWEST Piping Service

Every tube in the refinery needs a LAGONDA CLEANER

Cracking Still Furnace



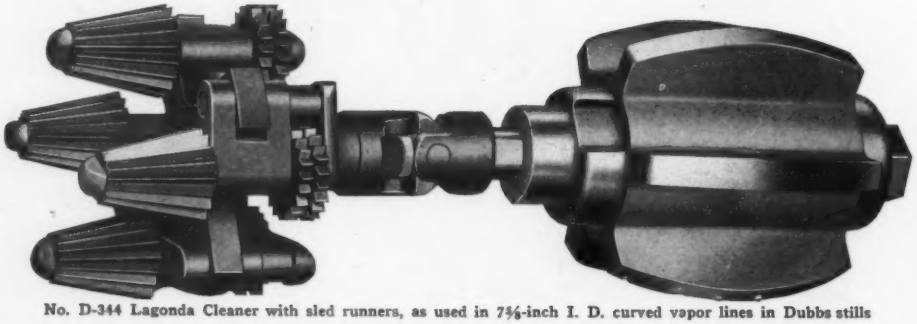
Lagonda Air Driven Cleaner for 3-inch I. D. tubes in cracking still furnace, equipped with long surface Quick Repair Head



Lagonda No. D-153 Cleaner for 2-inch curved pipe, as used in the residuum lines

Residuum Lines

Vapor Lines



No. D-344 Lagonda Cleaner with sled runners, as used in 7⅛-inch I. D. curved vapor lines in Dubbs stills

Extension piece used between Universal Joint and Drill, increases the cutting range of Drill in large size tubes

Large Size Tubes

Write for the bulletin with full information on tube cleaners for refinery needs.

The Lagonda Mfg. Co.
SPRINGFIELD, OHIO
FUEL SAVING SPECIALISTS

NEW YORK, CHICAGO, PHILADELPHIA, BOSTON, PITTSBURGH, CLEVELAND, CINCINNATI, DETROIT, SYRACUSE, BALTIMORE, ST. LOUIS, KANSAS CITY, DENVER, DALLAS, ATLANTA, SAN FRANCISCO, MONTREAL, LONDON.

Makers of Lagonda Boiler Tube and Condenser Cleaners, Tube Cutters, Cap and Header Reseating Machines, etc.

X-1427

Mention Where You Saw the Advertisement

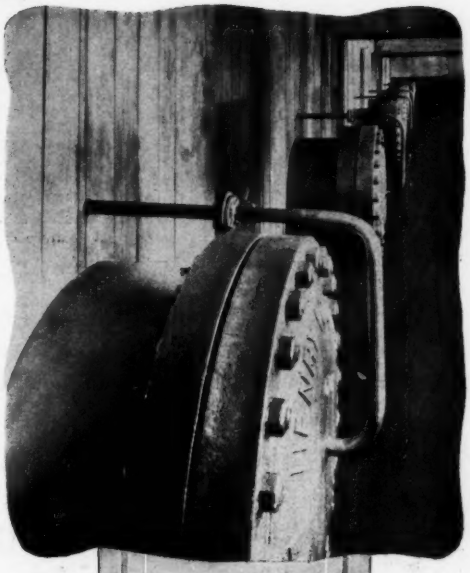
Recovering A PAYING BY-PRODUCT

THE demand for paraffine wax is constantly increasing. . .

The Vogt Paraffine Wax Filter Press~

is the best mechanical means for the complete separation of the wax crystals from the lubricating oil with the least expense for repairs or replacements.

Write for Details



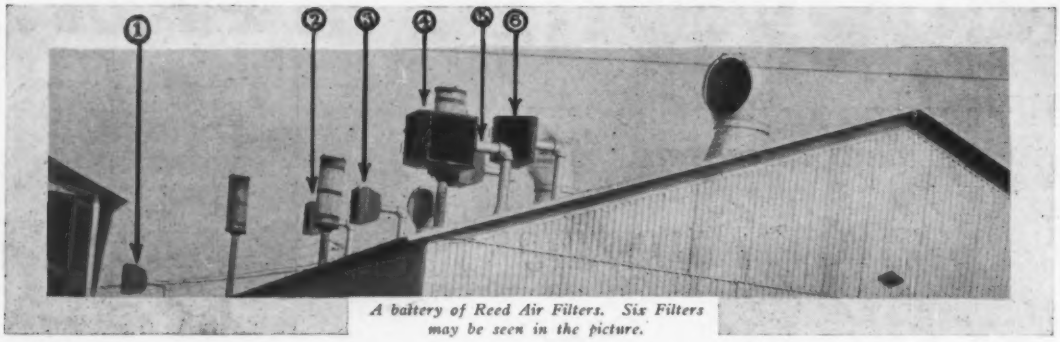
A BATTERY OF VOGT PARAFFINE WAX FILTER PRESSES

A CLOSE UP OF TWO-500 PLATE VOGT PRESSES

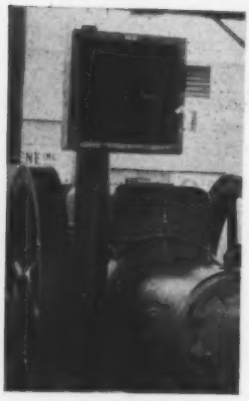
HENRY VOGT MACHINE CO., Inc.
LOUISVILLE, KY.

Branch Offices: New York Chicago Philadelphia Cleveland Dallas

Valuable Machines Deserve Protection

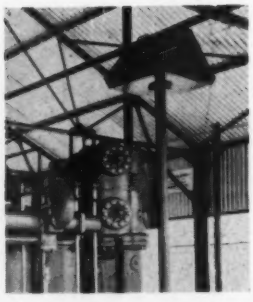


A battery of Reed Air Filters. Six Filters may be seen in the picture.



Presenting a few of the Companies at the 1927 Petroleum Exposition who used Reed Air Filters in displaying an ideal installation with their equipment.

Reed Air Filters provide 97% purity and cleanliness of air. All of the dangerous particles of dust—hard—scratching—wearing—are removed, insuring longer life, increased efficiency and complete protection to the surfaces so liable to injury from unclean air. Particularly in the oil fields and at refineries is clean air necessary. Valuable machinery—sensitive equipment—expensive materials are protected by the Reed Air Filter.



Wherever Reed Air Filters are used you will find enthusiastic supporters of every claim made for them. Every Filter is protected by the Reed Guarantee.

If you have valuable machinery that is not Reed protected, inquire for further information.

Reed Air Filter Co., Inc., Louisville, Ky.

Distributed to The Oil Industry by

SMITH SEPARATOR COMPANY

Tulsa Okla.

Texas Offices:
924 Post-Dispatch Bldg., Houston, Texas
1402 Ft. Worth Natl. Bank Bldg., Fort Worth, Texas

Louisiana Office:
405 Forest Ave., Shreveport, La.

California Office:
2039 East 38th St., Los Angeles, Calif.

Mention Where You Saw the Advertisement

There Is No Substitute for Quality ~ Banroc Cannot Be Successfully Imitated ~ ~ ~

The highest compliment that can be paid to any product is an attempt to imitate it.

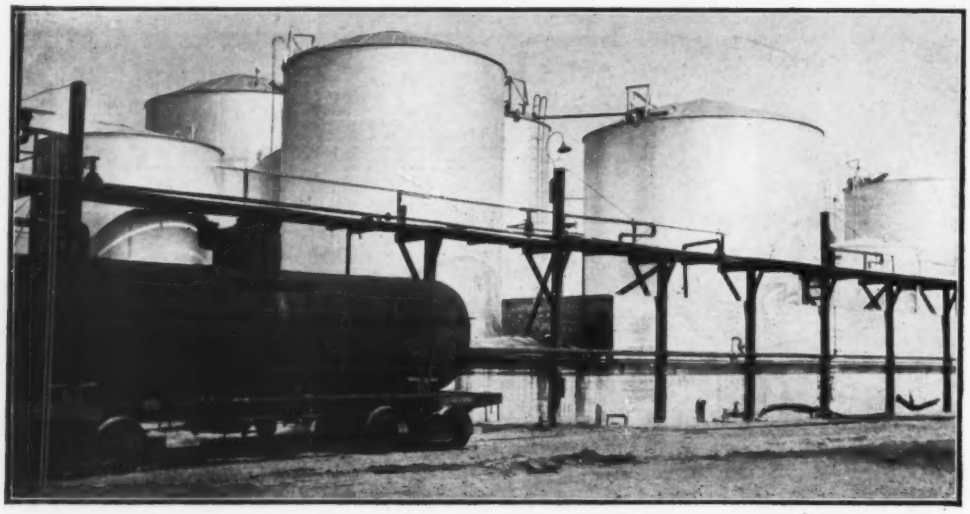
The many attempts that have been made to imitate Banroc are conclusive proof of its leadership.

Accept Only Genuine

BANROC
HEAT INSULATION

BANNER ROCK PRODUCTS CO.
ALEXANDRIA, INDIANA.

Don't be Fooled by Cheap Substitutions



California Petroleum Corporation Gasoline Tanks Coated with Bitulumin

HARMFUL ULTRA VIOLET RAYS
have slight effect
ON ALUMINUM PAINTS

BITULUMIN
Largely Immune.
Deflects 86%
of Destructive
Light Rays.
Outlasts Lead and
Zinc Paints Two
to One.

A correctly made aluminum paint like Bitulumin will outlast any lead and zinc paint on exposed surfaces by two to one. This is because of Bitulumin's peculiar "weather" resisting qualities. Paint's worst enemy is the sun, whose destructive Ultra Violet rays break down paint surface allowing moisture to penetrate.

Bitulumin is largely immune to this attack because it offers to the sun's rays an aluminum armor which turns away 86% of them.

In turning back destructive light and heat rays Bitulumin makes a cooler surface and in the case of tanks reduces evaporation.

Bitulumin, while extremely popular for painting oil storage, is not limited to that field. It is a many purpose paint and has demonstrated its unusual qualities for painting tanks, tank cars, refinery equipment, metal buildings and roofs, smoke stacks, steel bridges and many others.

Bitulumin, put up in double containers to insure fresh mixing, is manufactured by Hill, Hubbell & Company, manufacturers of a special line of paints for the oil industry.

HILL, HUBBELL & COMPANY

Manufacturers of
Highest Grade Oil Industry Paints and Pipe Line Coatings

Factories at SAN FRANCISCO and TULSA

District Offices:

LOS ANGELES — HOUSTON — NEW YORK CITY
SEATTLE — PORTLAND — BALTIMORE

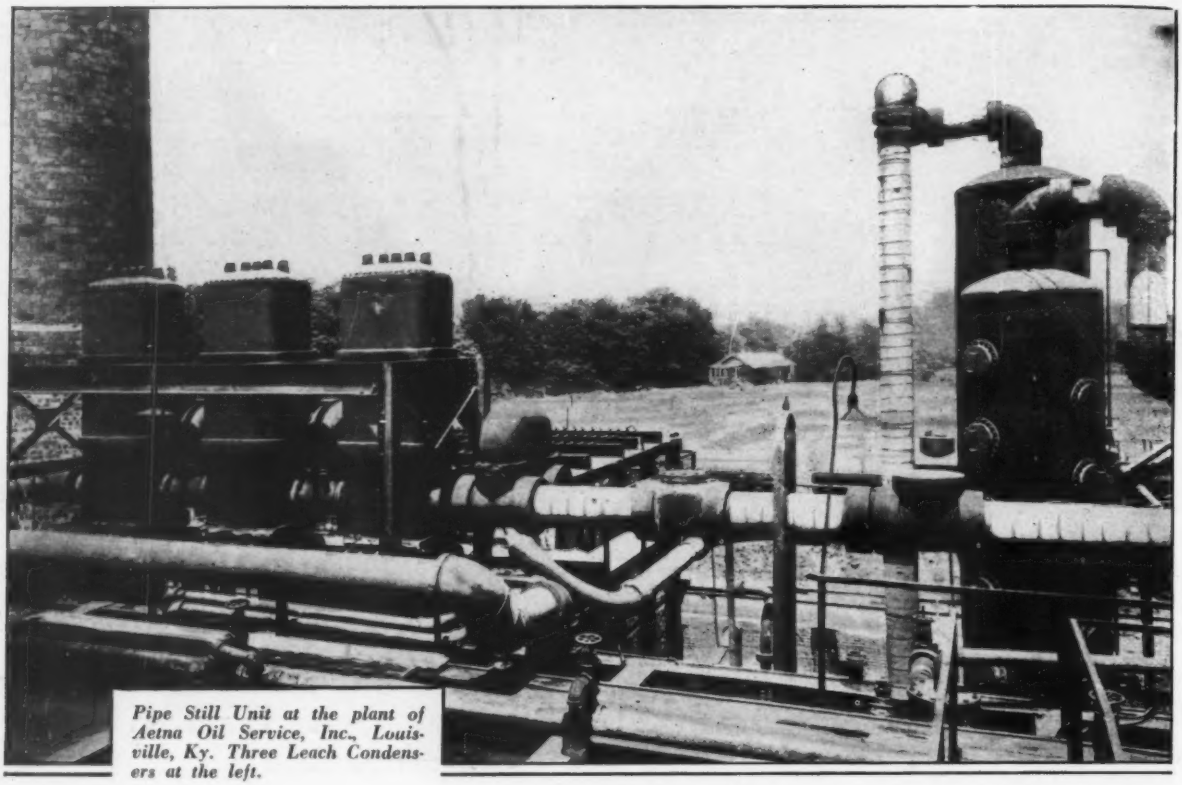
Mention Where You Saw the Advertisement

"At present, overproduction is approximately a million barrels a day.

"If this immense surplus were permitted to remain in the earth, our future needs would be assured, our national life more surely safeguarded."

Extract from the speech of Hon. Hubert Work Secretary of the Interior and Chairman of the Federal Oil Conservation Board, before the Mineral Law Section, American Bar Association, at Buffalo, August 30, 1927

Universal Oil Products Company
Owner of the Dubbs Process
310 South Michigan Ave
Chicago, Illinois



Pipe Still Unit at the plant of Aetna Oil Service, Inc., Louisville, Ky. Three Leach Condensers at the left.

The Leach Fracto Condenser *for* Low Fuel Consumption

A battery of Leach Fracto Condensers and Heat Exchangers in a pipe still unit at the plant of the Aetna Oil Service, Inc., of Louisville, Ky., is aiding in the daily production of 1500 barrels, with a fuel consumption of approximately .916 gallon per barrel throughput. The close control effected produces the finished product without resorting to the necessity of re-running overheads.

Leach Fracto Condensers provide for the close separation and control of one or several distillate fractions by facile adjustment and control of the cooling media. The unique design permits of ready access for cleaning, full floating of tubes, reduction of corrosion to the minimum, and a heat recovery equal to the installation cost within 200 to 600 days. It is in successful service in oil refineries on continuous and batch stills, both vacuum and pressure.

We will gladly furnish more specific information regarding the application of the Leach Condenser to any distillation process, as well as data relative to our complete line of High Vacuum Distilling Equipment.

We also manufacture:
Surface, Jet and Barometric Condensers; Oil Vapor Condensers for High Vacuum Distillation; Heat Exchangers; Sand Separators; Radojet Air Pumps for vacua up to 29.95 inches; Forced and Natural Draft Cooling Towers.

C. H. WHEELER MFG. CO.
19th Street, Lehigh and Sedgley Avenues, PHILADELPHIA, PA.

C.H.WHEELER *of* PHILADELPHIA

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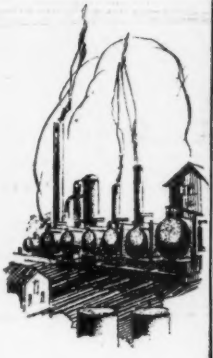
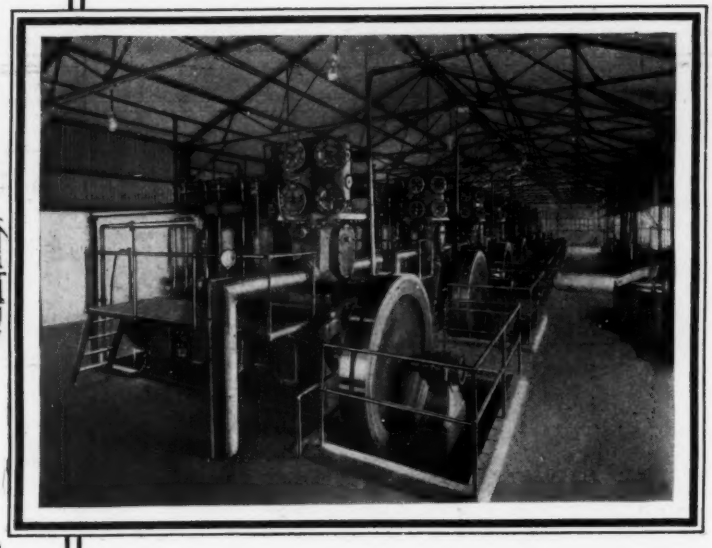
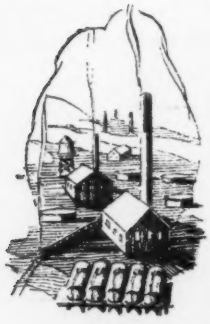
Where Dependability Counts







Day-after-day records are demonstrating conclusively the stand-up-ability of Hope Vertical Gas Compressors. Design and Construction are fundamentally sound—as the concrete facts of performance are proving beyond question. Where dependability counts—where unfailing reliability is the big thing, as well as high economy—the Hope Vertical is the logical choice.

Ask Us for the Bulletin

HOPE
ENGINEERING AND SUPPLY
COMPANY
MOUNT VERNON, OHIO, U.S.A.
DALLAS, TEX. TULSA, OKLA. CASPER, WYO.

ENGINEERS··CONTRACTORS
DESIGNERS··MANUFACTURERS

HE-45

SUNOCO

NOVEMBER

1927		NOVEMBER				1927
SUN	MON	TUE	WED	THU	FRI	SAT
✦	✦	1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	[24]	25	26
27	28	29	30	✦	✦	✦

Thanksgiving—we are thankful for the great number of Natural Gasoline Manufacturers who are using:

Sunoco Absorption Oils 630 and 670

You will be thankful when you join them because use of these two oils will:

630

Increase your daily gasoline production.

Lower your manufacturing cost per gallon of gasoline produced.

Control your end points.

670

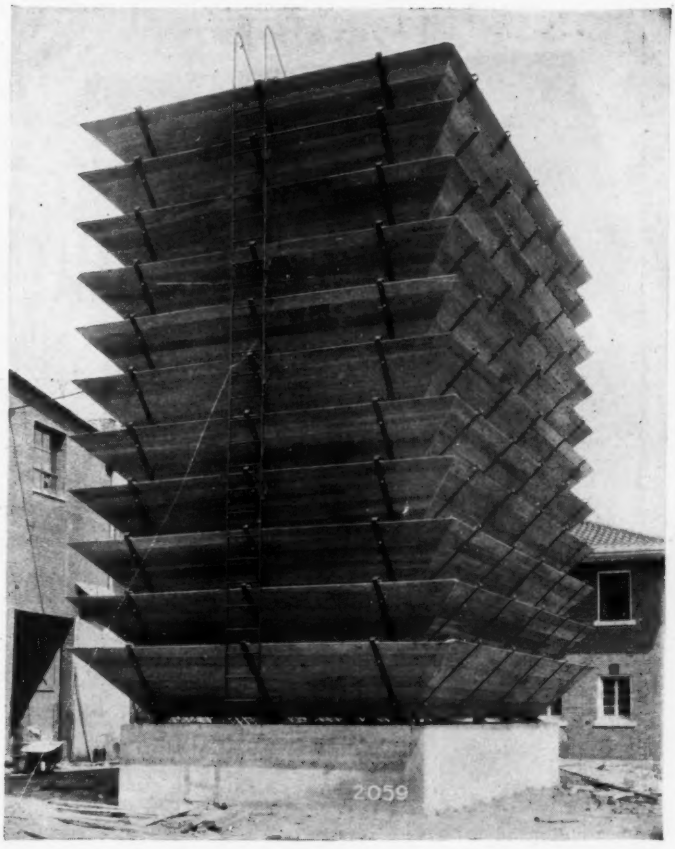
SUN COMPANY

Petroleum Bldg., Tulsa, Oklahoma

Refiners at

Marcus Hook, Pa. Yale, Oklahoma Toledo, Ohio

Wheeler Louver Type Cooling Tower



THE Wheeler Louver Type Tower has been developed for recooling the jacket water of Diesel engines and other purposes where a small quantity of water is required. It depends upon natural air currents for cooling effect.

All metal construction, all wood construction, or steel frame with wood filling and louvers, may be employed as fire regulations or other considerations dictate. Unless prohibited by other considerations, we recommend the wood construction, as it is considerably more resistant to corrosion under cooling tower conditions than steel, even if galvanized and kept painted.

The tower shown above is installed with a Diesel engine and is guaranteed to cool 450 gallons of water per minute from 160 degrees F. to 110 degrees F., or as an alternative, to cool 400 gallons per minute from 130 degrees F., to 100 degrees F., with the outside air at 90 degrees F. and 50% relative humidity.

Foster Wheeler Corporation, 165 Broadway, New York, N.Y.

A Consolidation of Power Specialty Company and Wheeler Condenser & Engineering Company

Branches in principal cities 123

FOSTER WHEELER

FRACTIONATING TOWERS HEAT EXCHANGERS
STEAM JET AIR PUMPS SUPERHEATERS
TUBE STILLS VACUUM PUMPS
WATER COOLED FURNACE SURFACES
BRASS AND COPPER TUBING AND PIPE

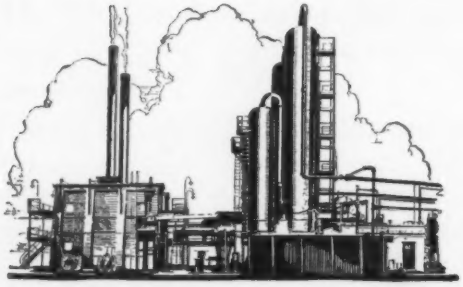
AERO UNIT COAL PULVERIZERS
AIR HEATERS CENTRIFUGAL PUMPS
CONDENSERS COOLING TOWERS
ECONOMIZERS EVAPORATORS
EXPANSION JOINTS FEED WATER HEATERS

KELLOGG PIPE STILLS

CERTIFIED PERFORMANCE

Of the many Kellogg pipe stills in use, not a single unit has ever fallen down on a guarantee.

In fact, the actual performance of every Kellogg still is exceeding the specified capacity for which it was originally installed. One plant, erected under a guarantee to handle 5,000 barrels, is now running 6,500 barrels in regular daily operation.



KELLOGG

CROSS CRACKING PLANTS—BUBBLE TOWERS—PIPE STILLS—HEAT EXCHANGERS—GRAY TREATING TOWERS—TREATING PLANTS

THE M. W. KELLOGG CO., 7 DEY STREET — NEW YORK

KANSAS CITY, MO., 700 BALTIMORE AVE. — — SAN FRANCISCO, CAL., 444 MARKET ST.

LOS ANGELES, CAL., 329 PETROLEUM SECURITIES BLDG.

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JENKINS CRACKING PROCESS

PRODUCES QUALITY GASOLINE

Facts from performance

Consider

the importance of the flexibility of the Jenkins Cracking Process which, without extra auxiliary equipment, permits the economic and profitable production of gasoline from—

Crude Oil

Topped Crude

Gas Oil

Residium

GRAVER Corporation *Founded 1857*

EAST CHICAGO, INDIANA

NEW YORK Grand Cent. Term. | CHICAGO America Fore Bldg. | TULSA Atlas Life Bldg. | HOUSTON West Building

The Holmes-Manley *Cracking* Process

Flexibility of Operation.

High Yield of Quality Gasoline direct from the Unit.

Fractionation and Condensation under Full Operating Pressure.

High Yield of Liquid Products with a minimum yield of fixed gas and carbon.

Low yield of Residue Fuel Oil of good Quality.

Relatively low Operating Temperatures.

Ease of Control.

Long Runs and High percentage of Operating Time.

Low Labor and Fuel Costs.

Address Inquiries to

THE TEXAS COMPANY

W. S. S. RODGERS

17 Battery Place, New York, N. Y.

Branch Office

816 Palace Building, Tulsa, Okla.

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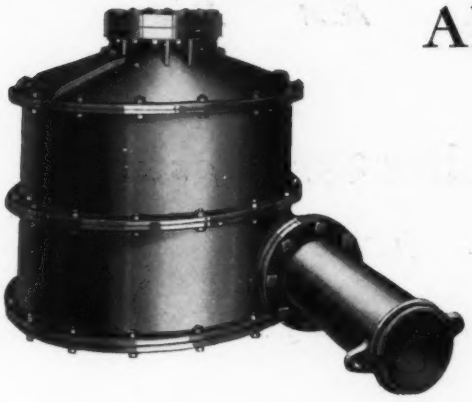
DEADENS THE EXPLOSION AND REMOVES THE FUMES —FOR NATURAL GASOLINE PLANTS ! ! ! ! !



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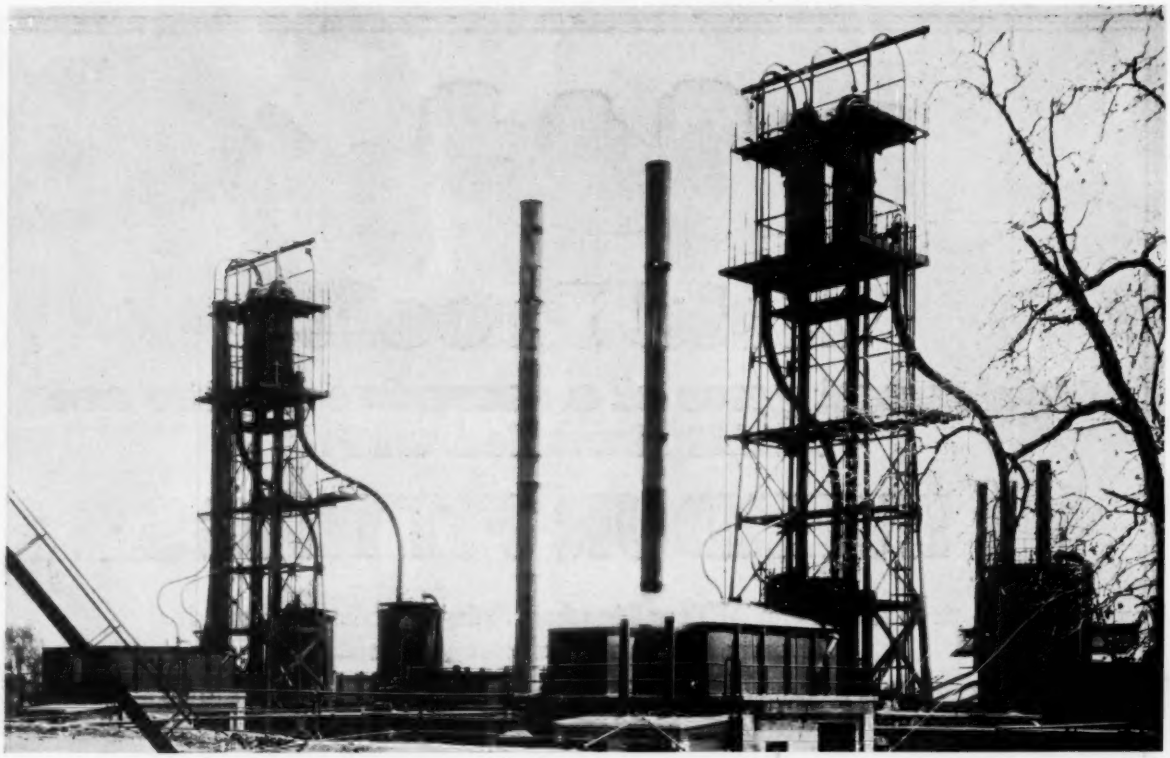

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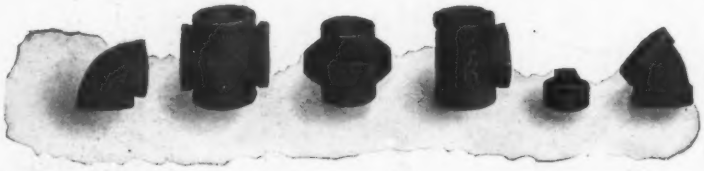

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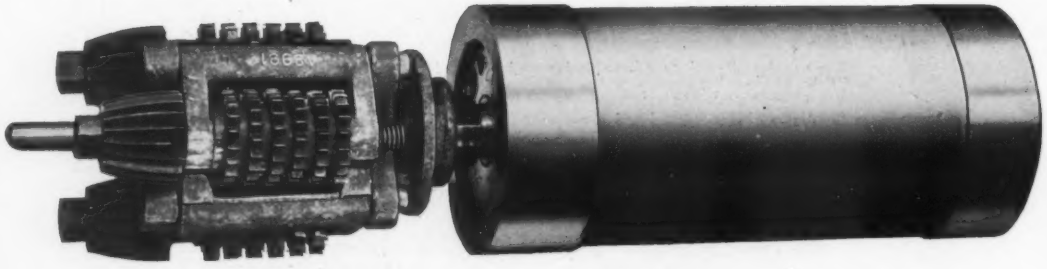

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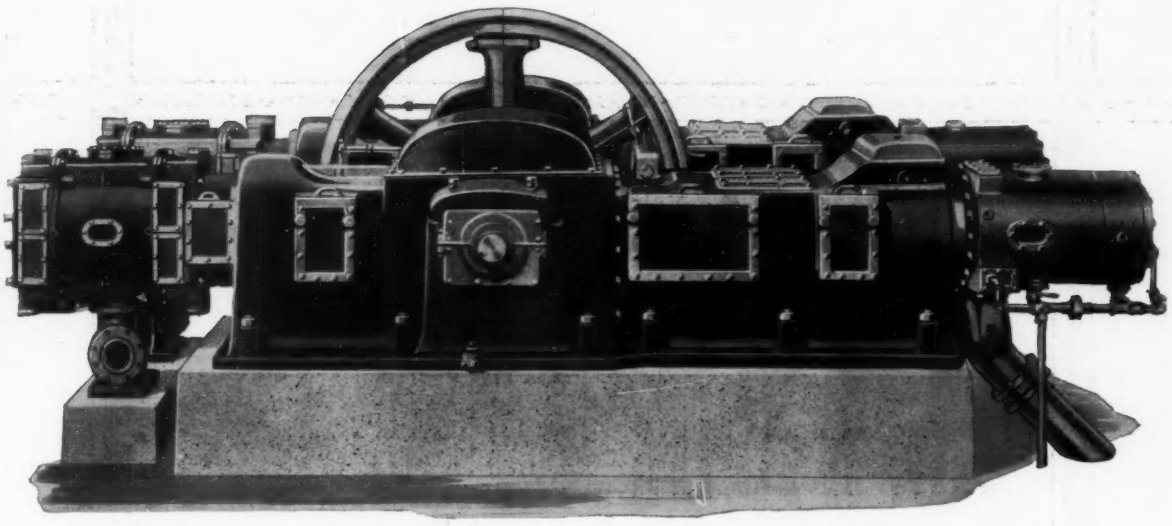

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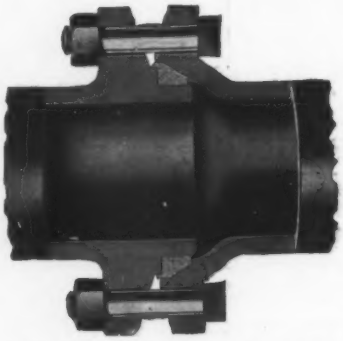

Illustration of section through assembled joint of Simplex Prepared Joint Five-Foot pipe, showing asbestos endless ring gasket in place. This gasket is adapted to use for oil, vapor and acid lines. A rubber gasket is compounded to suit the particular service it is to render—steam, natural gas, artificial gas, water, oil, etc.

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Vol. 6, No. 11

NOVEMBER, 1927

The REFINER

AND NATURAL GASOLINE MANUFACTURER

Edited Monthly at Tulsa, Oklahoma

GRADY TRIPLETT, *Editor* GEORGE REID, *Associate Editor*

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Economics Will Not Keep Still

THE Mid-Continent refining area presents striking evidence that the law of the survival of the fittest applies to industry as well as nature. The past summer witnessed the closing of several plants in both Oklahoma and North Texas. Others are due to quench their still fires during the winter.

Only part of those to close in the present depression of the industry will ever be fired again. Part of those which resume will later be closed permanently. The Min-Continent will witness the dismantling of more plants than are built in the next year, for there is nothing to indicate the building of new refineries right now.

Of the refineries to pass out of the picture permanently, many should never have been built. They were never warranted. Some were badly managed. In all, their passing brings little regret. Their right to exist never was on solid ground.

But some of those now being closed or due to cease operations are the victims of a changing economic condition. Failure to shape business to fit this change is in some part responsible for their closing, either permanently or temporarily.

Since the whole petroleum industry must follow economic demand, the refiner will do well to adhere to the changes.

One of the recent demands put on the refiner has been for a better grade of gasoline, usually with some value on the anti-knock specification. Indications are that the swing is toward still better grades of gasoline, especially as to volatility and for anti-knock qualities.

This demand on the refiner has been evidenced for more than a year. To some extent it has been responsible for the closing of small skimming plants in the Mid-Continent.

Evidently it is cheaper to make gasoline in large refining plants. Costs, of course, are treacherous. But the only plant construction of consequence in the Mid-Continent in the past two years has been the enlargement of existing refineries. It is significant, too, that no large plant has been shut down in the present depression.

More recently the freight rate controversy has been injected into the economic picture. Rates as affecting Group 2 and Group 3 probably are not definitely settled. But changes ordered by the Interstate Commerce Commission leave no doubt of the influence revised tariffs may have on refining plants.

The inland refiner has also for his consideration the fact that large refineries are being constructed at tidewater and along the Great Lakes. There are indications, too, that attempts may be made to place refineries with regard to consumption of finished products rather than with regard to the producion of raw material.

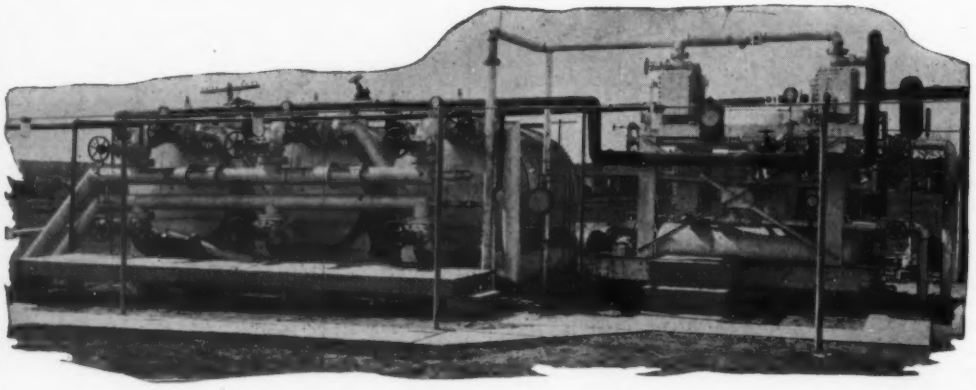
The whole is a condition of constant action. There is no hope of it becoming statical, so it can be studied more easily. The refiner must make his decisions from conditions that are changing.

The Mid-Continent area will continue to furnish great amounts of gasoline as well as other petroleum products. But the plants that furnish them in the future will be managed by men who can make proper decisions out of the changing economic picture.

Grady Tippett

CHAR process

—Of Gasoline Recovery—



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COAL

Transformer Oils—A Refining Specialty

By GEORGE W. CUPIT, Jr.
Chemical & Refining Engineer

AS every grade of manufacture has its "specialty," so in petroleum refining various products are made which require special methods of treatment, and hence a better knowledge of refining. The term "specialty" means something better than ordinary. In a manufacturing line the specialty is bought, because it either tastes better, looks better, produces a larger return, or lasts longer. It may, however, possess all four qualities. In refining the keynote of the special product in this instance is quality and incidentally "service." In general, special products of refining cost more, but the return is proportionally greater.

The subject of this article is "transformer oils." To the layman, the word transformer means little, unless he has studied electricity, and learned that in order to change from direct current to alternating current, or vice vesa, it is imperative that the positive and negative elements be surrounded by an absolute non-conductor. Certain components of mineral oils possess this characteristic, but before they may be termed "transformer oils" they must meet other rigid specifications; such as gravity, flash and fire points, cold test, sulphur content, organic acidity, alkalinity, sludge test, humidity, dielectric strength, a coloration standard, heat and volatility tests, and must be void of impurities.

An oil which will meet all these specifications is truly a "specialty" in petroleum refining. It may be well to mention here that all transformer oils do not have to meet every one of the above specifications, due to the fact that all transformer oils are not used under the same conditions; however, the majority should meet the above specifications. Those oils used in a hot climate do not have to meet as low a pour test as those used in a cold climate. Those used in transformers having lower voltages do not have to meet such a ripid dielectric strength test, etc. The conditions, then, under which the oils are to be used are the governing factors and for this reason the refiner is confronted with many interesting problems.

There are various grades of transformer oils, depending upon the nature of their source. The following specifications are given to illustrate the requirements those oils should meet:

Transformer Oil Made from Naphthenic Base oil.

Physical and chemical properties:

(a) The oil must possess a neutral reaction.
(b) Must be void of suspended impurities.
(c) Must be void of alkalis.
(d) Must be absolutely dry.
(e) Must not contain sulphur, resin, or asphalt.
(f) Acidity in terms of SO3—not over .02%.

Viscosity:—Engler
Not over 8. at 20°C.
2.5 at 50°C.
1.5 at 75° C.

Volatility—Should not be over .3 per cent heating 5 hours at 100°C.

Cold Test:—3°C.

(Minimum)

Flash Test:—Pensky Martens ..150°C.
Marcusson . .....160°C.
Luchaire . .....150°C.

Fire Test:—Marcusson .....180°C.

Dielectric Strength:—33,000 volts (Test made between 2 spheres 10 mm. in diameter, 55 mm. apart.)

Humidity—Nil.
Organic acidity—.005%.
Sulphur—Nil.
Color—N. P. A.—Not darker than 2.
Alkalinity—Nil.
Sludge Test (French Method—
5 hours—nil
50 hours—nil
135 hours—0.1

Transformer Oil Made from Paraffine Base Oil.

Physical and Chemical Properties—Same as or naphthenic base oil.
Flash (Luchaire)—170-175°C.
Flash P. M.—355°F.
Volatility (Holde Method) 0.18—0.3 per cent.
Volatility (French Method)—0.086 per cent.
Dielectric Strength—35,000 volts.
Sulphur—Nil.
Color—N. P. A.—Not darker than 1.
Viscosity—Engler at 20°C. 6. —6.2
Engler at 35°C. 2.9—3.
Engler at 50°C. 2. —2.1
Sludge Test (French Method)—
Heating at 150° C. for 5 hours—nil.
Heating at 150°C. for 50 hours—nil.
Heating at 150°C for 135 hours—trace
Pour test—30 Max.
Sp. Gr. at 60°F.—.857-.871.

Characteristics of Transformer Oils

From experimentation it has been noticed that transformer oils in contact with air produce sludge very slowly at any operating temperature below 175 degrees F., provided that the oil is of a good quality and is in the absence of any catalyst. The greater the amount of unsaturated constituents present within the oil, the shorter the life becomes on account of the tendency to form deposits. Therefore, the method of refining must be such that all unsaturated compounds present in the stock will have been removed when the last stages of refining are completed.

The effect of heat upon transformer oils is very marked in more ways than one. Firstly, it causes the oil to become dark and thick. Secondly, it causes the formation of sludge and unsaturated constituents, and acids. An example of this is given below.

A transformer oil with the following tests:
Saybolt Viscosity at 100°F. 55
Flash .....290°F.
was tested for unsaturation at a temperature of 77°F. and found to contain 6.0 per cent. Heat was then applied to the oil, increasing slowly until a temperature of 300°F. was reached. This temperature was maintained throughout the experiment, which required 28 days. At the end of the third day, the percentage of unsaturation was 10 per cent; at the end of the seventh day, it was found to be 13 per cent; at the end of the sixteenth day, 16 per cent; at the end of the twentieth day day 20.5 per cent, and at the end of the twenty-eighth day, 24.5 per cent. At the end of the experiment the oil was thick and full of sludge. The differentiation of transformer oils by their sludge test appears to be of little real value when the amount of sludge formed is below a certain value, as, for example, .3 per cent Holde-Kissling test, or 1 per cent British test.

Selection of Crude.

As our starting point, let us consider the nature of the oils from which we are to obtain our transformer stocks. If the finished oils are to be used in a cold climate it will be wise to select a low cold test oil, such as a Texas Gulf Coast crude. This crude possesses naphethnic properties which requires vigorous treatment in order to meet certain specifications.

The object of distillation is to produce an overhead cut which, when rerun, will give a transformer stock having a viscosity of 95-110 Saybolt with good acid treating properties. For this purpose a single worm still may be

used, using fire and steam for distillation. It will be unnecessary to outline in detail the processes for charging and firing the still, except that it is of vital importance to remember to induce all the steam it is possible during the reduction, and not to allow the temperture at any time to exceed 600°F.

Since it is desired to get an overhead cut which will give a maximum yield of transformer stock, the best method of cutting is as follows:

Cut No. 1—Over 42° Be.=Crude Naphtha.

Cut No. 2—42° Be. to 150 Abel Flash =gas oil unfit for Pressure Stills.

Cut No. 3—150 Abel to 60 Vis at 100° F.=gas oil (fit for Pressure Stills).

Cut No. 4—60 Vis to 170 Vis at 100° F.=250 Stock (Light).

Cut No. 5—170 Vis to 18% Bottoms =250 Stock (Heavy).

The distillation may be considered complete when Cut No. 5 is run as given above, or when the bottoms in the still are 76-80 Vis at 210° F. The viscosity of the two stocks (light and heavy) will be approximately 95-100 at 100° F. and 300-340 at 100° F. respectively. The two stocks may be added and rerun for 95-105 Vis at 100° F. Saybolt (transformer stock) or rerun separately. If they are rerun together the charge will equal approximately 42% of the crude oil started with, but if rerun separately, the light 250 stock (Cut No. 4) will be approximately 25 % of the original crude charged and the heavy 250 stock (Cut No. 5) will represent 17 per cent of the crude oil charged. On rerunning the combined 250 stocks for the transformer stock it will be necessary only to make two cuts overhead,—namely, a 5 per cent gas oil cut, and a 50 per cent 100 viscosity cut. It is this second cut from which the transformer oil will be made.

Preparation for Charging

Ascertain whether the distillate to be charged for acid treating meets the specifications for viscosity, flash, pour and gravity. Try the distillate tank before starting to charge for water. If O. K., get an accurate guage, and temperature on tank. Set line for pumping and inspect treating agitator for sludge. Make sure bottom valve is closed. Make sure charging line is clean to agitator. The temperature at which the distillate should be treated is 60-65° F. In the winter this treating temperature is easily maintained, but in the summer difficulties arise and the temperature averages approximately 85-90° F.

When the above has been carried out, start charging and make sure that the oil is going to its proper destination. When agitator is charged to the correct outage, (determined by gauging), retain a quart sample of the charge for the laboratory. Take the after gauge on the charging tank.

Acid Treatment of Oil

Get an accurate guage on the acid tank and set acid line for pumping, or blowing, the acid, as the case may be. Start acid on the oil agitating with air, while the acid is going on. The amount of 66° Be. sulphuric acid used on the first dump is six to eight carboys of acid per 100 barrels of oil charged. The acid and oil are blown 45 minutes and allowed to settle approximately five hours. The sludge is then pumped from the bottom of the agitator and a like amount of acid is pumped or blown into the agitator, thus representing the second dump. The same procedure is now followed as in the case of dump No. 1, and No. 2, except that the third dump, 28 carboys of 98 per cent sulphuric acid per 100 barrels charged are added, lengthening the blowing time to three hours. The agitator is allowed to settle 12 to 14 hours, at which time the sludge is pumped off and a subsequent dump of 98 per cent acid added. The length of time blowing is the same as in the third dump. Allow to settle 12 to 14 hours, pump off sludge and three hours later clean down agitator to remove last traces of acid sludge. At this point the sour oil is ready to be transferred to the wash agitator.

Transferring Sour Oil to Wash Agitator

Set correct lines for transferring and make sure all division valves on agitator are closed. Lower suction line in agitator and start pumping. When oil has reached the wash agitator, regulate the caustic soda flow, which is tied into the oil suction on the pump, so that a sample taken from the discharge line, as well as from the agitator, and tested with phenolphthalein shows a slight pink color, indicating alkalinity. When all oil is transferred, close soda valve and blow line. Allow neutralized oil to stand six to eight hours and draw off all soaps previous to washing.

Washing of Oil

After the heavy sulphonic (or naphthenic) soaps have been removed from the bottom of the agitator make sure that the remaining oil is neutralized. Turn open steam on oil and observe from the top of the agitator its action upon the oil. If a tendency to emulsify occurs, shut off the steam and allow to settle. Draw off any soaps that have settled and re-steam. When indications show that the oil will wash without emulsifying, allow to steam until a temperature of 160-170° F. has been reached, and steam 45 minutes longer. Add approximately 20 per cent by volume of hot water and steam one hour longer. Shut off all agitation and allow to settle eight to ten hours. Draw off milk water and pump the oil to the bleachers to be brigthened.

Brightening the Oil

This step is comparatively easy, as it simply involves blowing all the moisture from the oil by means of air at the washing temperature. When oil is bright it is ready for clay treatment.

Effect of Clay Upon Oil

Although the color of a transformer is without a doubt an important selling point, yet it is by no means a criterion of the quality of the oil. This is a fact that many motorists have failed to learn before buying various grades of motor oils.

One of the vital factors in the application of the clay to oil is the proper selection of the clay. A second important factor is the preparation of clay. It is only in very recent years that the application of fine clay to oils for decolorations, and likewise neutralization of acid treated oils, has been successfully used. The finest part of the clay (after grinding), which was at that time found useless commercially, and which was discarded, is now being used to great advantage in contact work. It has done away with the use of caustic soda and soda ash in many instances and has incidentally eliminated emulsions. The important quality of the clay is that it has a neutralizing effect on the excess acid, acid pepper (fine particles of dispersed sludge) and SO_2 gas present in the oil after acid treating.

It is still a question whether the organic acids (formed during sulphonation) are partly or completely removed by the action of the clay on the oil. Some authorities maintain that they are removed and others maintain that they are neutralized, but remain as such in the finished oil. However, in either case, the oils are void of any acid reaction.

The first application of the powdered clay was made after it had been burned at a temperature of approximately 500-550° F. in a rotary kiln until thoroughly dry and void of carbonaceous matter. In many refineries the clay thus prepared is used in making not only transformer oils, but paraffin base—pale and red lubricating oils, as well as naphthenic base—pale and red oils.

More recent experimentation has shown that the filtering properties of the the clay have been increased four to five fold by acid treating the clay, washing and then burning. The clay thus prepared has acquired the name of "activated clay."

Application of Clay to Oil

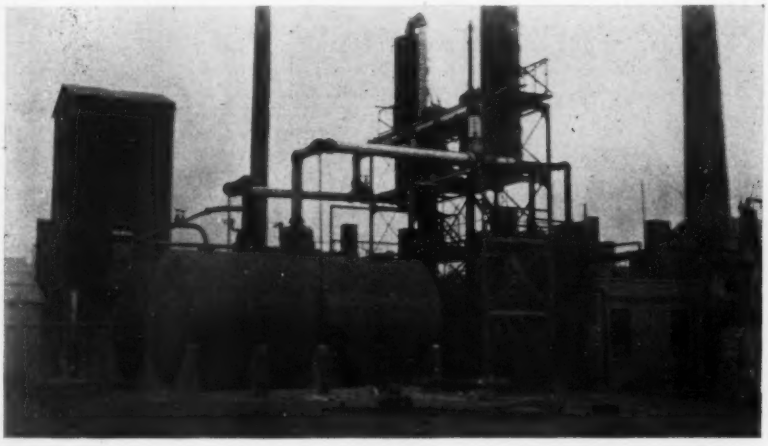
After the clay has been burned at 500° to 550° F. it is allowed to cool to a temperature of 300° F., at which time it is added to the oil, which has been heated to the same temperature, and agitated by means of a revolving metallic paddle. Wood should be avoided in order to prevent coloring of the oil, due to tannins and other coloring matter which may be present. The amount of clay used should be approximately six to eight per cent by weight, of the oil treated and the agitation should last one-half to three-fourths of an hour. Care must be taken not to allow the temperature of oil and clay to drop below 300° F. throughout the entire agitation. When the oil has been agitated the required length of time, it is pumped with the clay through a filter press and the filtered oil returned to

(Continued on page 66)

Clay Treatment of Long Residuum In Distillation of Light Cuts

By GEORGE REID
Associate Editor

THE Bradford Oil Refining Company, Bradford, Pennsylvania, in employing tube still distillation circulating through a shell still type separtor and treating the oil while in this process with contact clay, followed by filtration and centrifugal dewaxing has perfected and is operating its refinery with a novel and unusual hook-up. All three processes are well known to the industry but the Bradford company has designed its plant to operate in a manner different from that of any other refinery, possibly, in this country.



DISTILLATION AND FRACTIONATION EQUIPMENT, BRADFORD OIL REFINING COMPANY

Briefly the distillation process consists of skimming the lighter components off of the crude, then in the same apparatus mixing the long residuum with contact clay. This is accomplished by employing two shell still type separators and one tube still in the following manner,— first one of the separators is charged with the required amount of crude oil, usually about 600 barrels. When the vaporizing chamber is charged, the tube still, which is of the Foster type, four-inch, and 1000-barrel capacity, is fired. The crude is started circulating from the separator to the tube still with a Wilson-Snyder hot oil pump, size 16 by 10½ by 18 inches taking suction from the separator and discharging into the pipe still. For handling the oil in the same manner from the No. 2 separtor a Worthington hot oil pump, size 14 by 8½ by 18 inches is provided. These pumps are designed to handle oil at a temperature of 650 degrees Fahrenheit and at the rate of 350 gallons per minute.

As the oil circulates through the pipe still and back into the separator it is gradually raised in temeparture until distillation begins. The vapors are conducted away from the large separating chamber through a 6 by 40-foot bubble type tower, where it is fractionated and the accumulating reflux drained back into the separator.

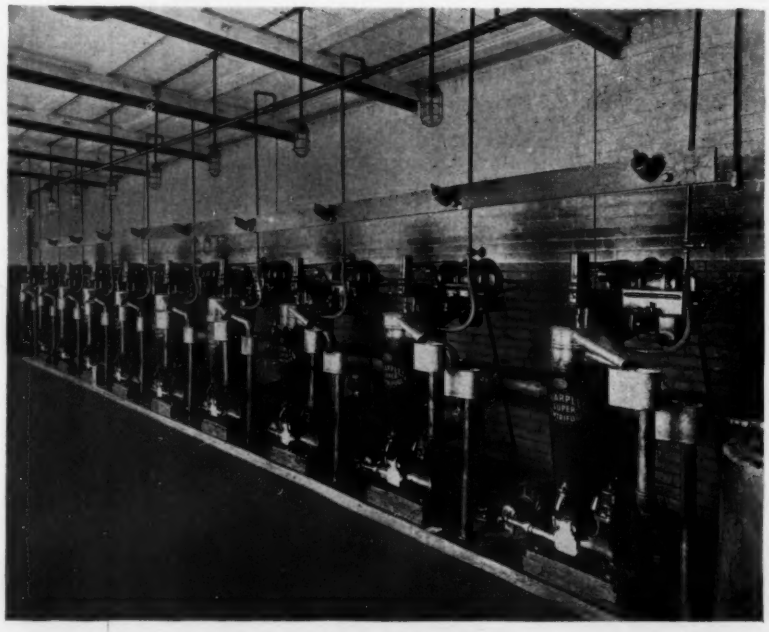
Before the vapors reach the Southwestern condensers they pass through a Leach shell and tube heat exchanger. At this point the hot vapors are passed counter-current to cool crude oil which is being charged to the second shell still type separator. This exchange effects a relatively large raise in temperature of the incoming crude oil, and by the time the No. 2 separator is charged half full of crude the temperature is usually around 300 degrees and light vapors are being taken off, fractionated and condensed while this second separator is charging. The rate of charging is so timed, that when the second separator is charged, the tube still is through handling the crude charge in number one separator and the second batch is started circulating.

To get back to the handling of the oil in No. 1 separator, when the circulation through the pipe still has proceeded to the point where sufficient temperature is imparted to the oil to cause the vaporization of all of the gasoline, naphtha, kerosene, and gas oil, the bottoms are ready for the contact clay treatment.

Completely stripped of the lighter components the long residuum remaining in the separator-tube still unit, is pumped into the contact clay treating chamber while hot. The oil circuit is then from the oil-fired pipe still, into the separator, then into the clay mixing tank, back to the separator and to the pipe still, repeating the circuit until the long residuum, mixed with the clay in the proper proportions is reduced to the required flash point.

Contact clay is received at the plant in

(Continued on page 52)



BATTERY OF TEN SHARPELS SUPER-CENTRIFUGFS IN PLANT OF BRADFORD OIL REFINING COMPANY

Lean Gas Profitably Handled in North Louisiana Plant

Operation of gasoline extraction plant in connection with carbon black burning, and high well pressure part of secret

By GEORGE REID
Associate Editor

THE Columbian Gasoline Corporation, manufacturing natural gasoline from the lean gas production of the mammoth Monroe, Louisiana, field, profitably operates its plants on gas averaging a yield of 150 gallons of gasoline per million cubic feet of gas treated.

Gas which would be considered very lean, or dry, in other sections, is looked upon as rich in the Monroe gas field of Louisiana. Gas yielding gasoline at the rate of 125 gallons per million cubic feet when re duced to the content of 1000 cubic feet, yields but one pint per thousand. One quart per thousand feet, means 250 gallons per million cubic feet. Operators in the Monroe field speak in terms of gallons per million. The richest gas in the field yields about 600 gallons per million feet. Many plants operate on gas with a gasoline content of around 100 gallons per million. The handling of this lean type of gas has, during the past eight or nine years, presented a number of operating problems to the manufacturers of natural gasoline, and while gasoline is considered more or less as a by-product of the carbon black industry in this particular section of the Mid-Continent field, the operators have, nevertheless, succeeded in solving their peculiar problems and in running their installations profitably.

The Louisiana conservation law requires that gas be processed for the removal of its gasoline content before it may be burned for the production of carbon black if the gas is found to contain gasoline at the rate of 150 gallons per million cubic feet or 0.15 gallons per thousand. The fact that many operators process gas which bears much less gasoline than the above requirements of the law, indicates that plant operation is sufficiently efficient to warrant such operation, even upon the very lean gas. The practice of treating the leanest gas in the field also indicates something of the co-operative efforts of the carbon black industry toward conservation of the gasoline.

The Columbian Gasoline Corporation operates eight gasoline plants in North Louisiana and one in Texas. The Fowler plant of this company, located at Fairbanks, Louisiana, is its largest installation, and this plant is one of three which the company operates in the Fairbanks district. Gas treated at the Fowler plant has an average gasoline content of 150 gallons per million cubic feet, or slightly over one pint per thousand.

Permanent Installation

The Fowler installation, like the other company plants in this section, was designed and constructed for permanency. Each building is floored with concrete; walkways connecting the steel buildings housing the plant equipment are of concrete and plant design takes into consideration the factors of cleanliness, accessability and safety.

Power house equipment consists of three 300-horsepower Union Iron Works water tube boilers, each of which are equipped with Kitts water level controllers, injectors being installed as auxiliary units, and water pumps for feeding. Gas is used for fuel, and its flow to the Duquesne combustion units is controlled by a large gas volume control regulator. The water feed pumps are two-inch centrifugal Coppus Turbo Feed pumps, steam driven. Through this type of regulation the power house control is practically automatic. The water supply for the power house is derived from a nearby stream and is of such a nature that no chemical treatment is required. At the stream side the company has a pump house, equipped with steam pumps which are driven with natural gas as it comes from the gas wells, the exhaust gas from the pumps being returned to the line and conducted to the carbon plant. Since the gas is of sufficient pressure coming from the wells, to operate the pumps, the operation of the water pumping plant is conducted at a reduced expense. Due to the fact that the water is abundant and inexpensive, and natural gas for fuel is very cheap, the item of steam generation and consumption is not one of great importance in plant operation and steam is freely used about the plant.

Cheap fuel and water is one of the factors offsetting the extreme leanness of the gas in the Monroe fields. Another item of much more importance in this connection, than cheap steam, is that of the elimination of the familiar gas boosting station in other fields. Well pressure is sufficient for absorption plant operation in all parts of the field and no compression plants are required. The Fowler plant of the Columbian organization operates at about 125 pounds pressure direct from the gas wells. These two items effect the elimination of a very large part of the normal expense of gasoline plant operation, which in a way compensates somewhat for the leanness of the gas treated.

Operation of the absorption plant proper is similar to that of other districts, except for the operating pressure of 125 pounds per square inch, and the large volume of oil circulated. The absorbers are of the vertical type, 3 feet by 40 feet in dimensions, packed with about 12 feet of small Raschig rings with voids both above and below the packed section. The number of absorbers, however, is of interest, since the Fowler plant with its 27 absorption towers in a single battery is perhaps the largest installation of its kind. These towers are capable of handling gas at the rate of 80,000,000 cubic feet daily and they have been operated at that capacity.

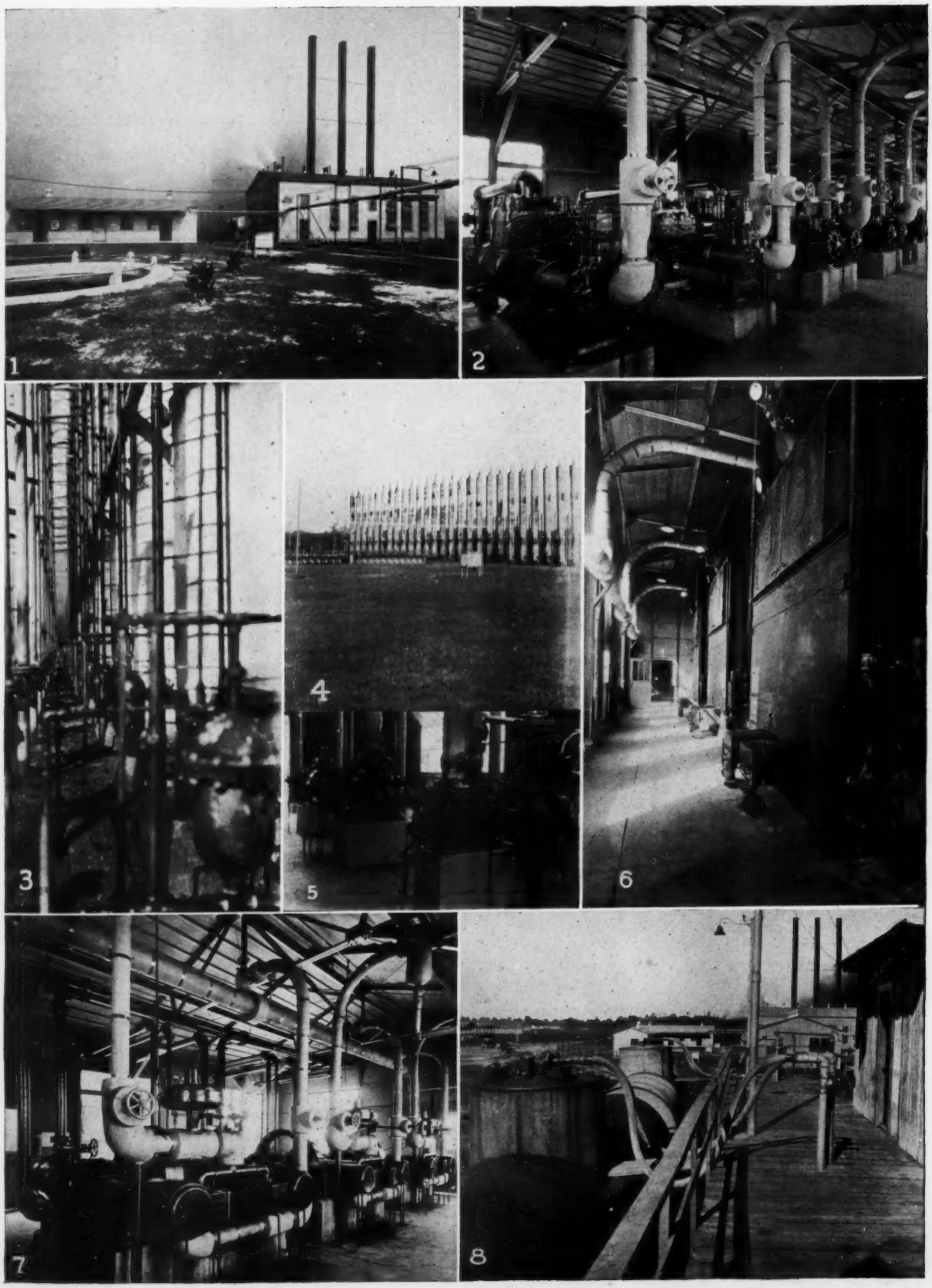
Oil Circulation

The operators have found that for the efficient extraction of the gasoline from the gas being treated it is necessary to circulate about 20 gallons of absorption oil per thousand cubic feet of gas, or 2000 gallons of oil per million cubic feet. Another way or stating oil circulation figures is that approximately 100 gallons of the absorption oil is circulated per gallon of gasoline recovered in one of the plants. The figures are approximate, since various plants operate on gas of varying characteristics.

Each of the absorber towers is controlled as a separate unit. Chaplin-Fulton oil regulators control the flow of absorption oil into the towers. The gas inlet and outlet lines are four-inch, and the oil lines in and out of the towers are two-inch. Each tower is provided with test connections for sampling oil, both going in the tower and leaving it.

Lean absorption oil is circulated from the still through the heat exchanger, through the cooler, and into the absorption towers by a Deane Brothers 16 by 8 by 18-inch duplex pump. The rich obsorption oil is circulated by a Dean Brothers 12 by 10 by 18-inch duplex pump, through the heat exchangers and preheaters and into the still, picking the oil up at the vent tank. These pumps are much larger than those usually found in the average gasoline plant in other districts, but they are necessary because of the very much greater quantity of absorption oil circulated through the plant. The absorption medium employed is a special oil prepared in accordance with the specifications of the gasoline producing company. Saturation of the absorption oil leaving the towers averages about 1.25 per cent.

The rich absorption oil flows from the absorbers to the still passing counter-current to the hot denuded oil leaving the still, through a welded heat interchanger* constructed in three sections. These exchangers consist of four-inch pipe inside of eight-inch pipe. There is a total of 144 joints, 20 feet in length, of each size, or 1880 feet of each size, in the exchanger. Leaving the third section or unit of the exchangers the rich oil passes through a short preheater section where it is further



1. Office, laboratory and boiler house of the Fowler plant of the Columbian Gasoline Corporation, Monroe, Louisiana, gas field. 2. Interior of the pump house. 3. Looking through line of 27 liquid level regulators. 4. Twenty-seven absorption towers in one battery. 5. Steam driven centrifugal boiler water feed pumps. 6. Interior of the power house. 7. Interior of recompressor house. 8. Loading rack, with return line for vapors.

heated with live steam just before it enters the still. Oil entering the still is sprayed into it at about the top of the horizontal shell, entering through 54 one-inch lines, 27 of which are on each side of the still. A baffle is provided above the sprays inside of the still to prevent its carrying off in the vapor lines. The oil falls into the accumulated absorption oil in the bottom of the still, virtually stripped of its gasoline vapors, and is kept in agitation by exhaust steam.

Gasoline vapors derived from this distillation are conducted through eight-inch vapor lines into the bottom of a dephlegmator, where any entrained absorption oil is removed. The clean vapors are then cooled and condensed at atmospheric pressure. Dephlegmator and still temperature is controlled by Foxboro automatic temperature controllers.

Up to this point the plant operation features are similar to the usual absorption plant practice, but the re-compression of uncondensed vapors after this condensation at atmospheric pressure is a little different from customary methods. The vapors which do not condense at atmospheric pressure are picked up by compressors and compressed on the low side to about 40 to 60 pounds, and passed through additional cooling coils. The gasoline thus produced is conducted to the specially designed accumulator tank, and expanded from its pressure to atmospheric pressure, blending with the first condensate derived from the distillation operation. The uncondensed vapors from this operation are conducted away and into the high side of the machines where they are compressed to 200 to 250 pounds pressure and again passed through the cooling coils. The gasoline thus produced is also taken to the accumulator tank where it is expanded from its high pressure to atmospheric pressure to blend with the gasoline produced by the two previous operations—that of atmospheric distillation and condensation at 40 pounds pressure. The accumulator tank employed, is of company design, and the proper name for it should perhaps be stabilizer, or rectifier, since the expansion of the two compression types of gasoline are caused to mix or blend with the gasoline derived from the still in such a manner that excellent stabilization is effected.

The compression plant also produces gasoline from vapors derived from storage tanks, and from the loading rack when the cars are loaded. The compressors are Ingersoll-Rand Type 10 machines, operating at the pressures mentioned, but pulling but a very slight vacuum on the small tank from which the vapors for compression are derived.

After the vapors are compressed they are recirculated through the system until all of the gasoline is removed and the non-condensible portion of the vapors is released through a safety valve and conducted to the boilers through the fuel line.

When the gasoline produced from these "tail gases" at 200 pounds pressure is expanded to atmospheric pressure it becomes very cold. The company takes advantage of this fact by conducting a portion of this light gasoline away from the plant and expanding it into their own ice plant where it cools the brine and causes the refrigeration of about ten tons of ice daily. The gasoline is conducted back to the plant, compressed, and blended with the plant production through the system as described. The ice plant paid for itself the first year of its operation. No additional labor is required for its operation.

Plant operation is checked periodically through a central laboratory which looks after the control of three plants located in the Fairbanks district. The customary charcoal test is used, operating at atmospheric pressure, checking the residue gas against the incoming gas. Saturation of absorption oil is also frequently checked.

The Fowler plant production approximates 88 to 89 gravity gasoline with a 60 to 65 degree F. initial boiling point, 300 to 320 end point and 85 per cent recovery; residue 1.4 per cent. Gasoline production is doctor sweet and non-corrosive to copper.

After the natural gas production is stripped of its gasoline content through the absorption plant, it is then conducted to the nearby carbon black plant and burned for the production of carbon black.

Clay Treatment of Long Residuum in Distillation

(*Continued from* page 49)

200 pound bags. This clay is mixed with the oil to be treated in proportions of about three fourths of a pound per gallon of oil. Before each run the required amount of clay is determined. A bucket conveyor raises the clay into a hopper where it is automatically fed into the hot oil in the mixing tank. This mixture of clay and oil is kept in constant movement by means of a mechanical agitator. A small pump removes the clay-oil mixture from the cone bottom of the tank discharging it back into the separator, or shell still, from where it is circulated to the pipe still and back. There is no fire under the separator, but agitation is produced by the use of bottom steam in the conventional manner.

Sufficient clay is used to produce a finished long residuum of six to seven N. P. A. color. This procedure accomplishes three steps in the one operation. First the batch of oil is distilled of its lighter components, gasoline, naphtha, kerosene, and gas, oil,—then the vapors leaving the distillation unit are caused to impart some of their heat to the cool crude being charged through the heat exchangers to the second large separator, and the long residuum is given its treatment of contact clay. When the contact clay treatment is completed the first separator is pumped out, and the tube still begins circulating the oil in the second separator, and the subsequent treatment with clay follows for this batch of oil. Then the first separator is again charged and ready for circulation and treatment. This describes the cycle.

From the separator, after reduction to required flash point the mixture of clay and oil is pumped to a dilution tank. Fifty per cent of naphtha is added here and the diluted stock is pumped through a No. 12 Sweetland press, where the clay is removed by filtering under pressure. Leaving the filter the oil is conducted to a heating and blending tank.

The Bradford company does not find it necessary to blow the clay cake with air and wash with naphtha, but by blowing for a few minutes with dry steam the clay cake becomes very dry, and is removed from the press in the usual dumping manner and discarded.

In the second heating and blending tank sufficient naphtha is added to the already diluted oil to make the mixture about 65 per cent naphtha. This solution is then conducted to the chilling tanks, of which there are three, where the oil is chilled to about 10 degrees below zero. These chilling tanks are each equipped with mechanical stirrers which serve to prevent settling of wax while the oil is chilled.

From the chilling tanks the solution is pumped into an elevated tank in the centrifuge plant. The oil flows by gravity into a battery of 10 Sharples super-centrifugal machines which remove the chilled wax from the oil. Oil freed of its wax is then taken to a battery of four shell stills where the naphtha in solution is distilled and recovered for re-use for dilution of further long residuum. The residue remaining in these four stills is finished bright stock of 6 to 7 color and the required flash and fire test.

Through the use of this type of equipment and operating process the company has eliminated re-running of its lighter cuts, the usual great amount of equipment conjunctive with the filter house and percolating type of filters, nor is a wax plant required for handling its neutral oils. Fullers earth handling equipment is not needed, nor is a clay burner. The contact clay method of treating while the oil is hot and in its original distillation equipment has been found very effective. In the design of this plant the company required a much smaller initial investment than is necessary for the usual type of plant doing like work.

In the perfection of this new type of refining plant for Pennsylvania crude the company engineers met with many problems, such as the proper amount of clay, proper feeding rates, velocities, and rate of application of heat, before the right balance of operation was found. During the past year, however, the plant has been operating very satisfactorily, and with economy of fuel cost and other overhead operating expense. Gasoline recovery was increased as well as plant capacity. The refinery as it is at present operated was designed and installed by J. H. Rose, president of the company and plant superintendent. W. R. Reck, Max B. Miller Company, Inc., and H. S. Bell consulting refinery engineer, were consultants in the construction of the plant. The system of refining as described is something new in the refining of Pennsylvania oils and much interest is manifest in the operation of the plant.

Automatic Temperature Control In Refinery Processes*

By F. M. POOLE,
Brown Instrument Company

IT would appear that this consideration of automatic temperature controls is a very timely one—for, it was only a few days ago that most of us were in Tulsa where there were on demonstration a number of temperature controls.

To you gentlemen, as refiners, automatic temperature control is of vital interest; it will do much in the future toward helping you keep your balance sheets out of the "red;" its possibilities have merely been touched heretofore.

For purposes of consideration, I am separating the problem of temperature control into the application to the fuel supply to your furnace, whether it be a pipe still, cracking still, or lubricating unit, and to your fractionating towers, or in other words, to the "input" and "output" of your plant.

Furnace Applications

In the past when automatic temperature control has been applied to a furnace, it has been of the "off and on" type. This usually comprised a pyrometer actuated from a thermocouple, located either in the oil path or the furnace combustion chamber, which is made by means of a high and low contact in the instrument, to open or close the valve in the fuel supply to the burners. This means that the fuel valve was either in one position or the other. (This excludes the so-called thermometer air type controls which cannot be used to control from furnace temperatures, and only within a limited range from oil temperatures.) This type of control is similar to that used in other industries such as the heat treating. In such industries, this type of control is used with satisfaction. The reason is that the temperature changes required are usually marked and rapid, and the time required for treatment is relatively short. The "off and on" control, when applied to the oil industry, has done the work required but its adaptation has not been as complete as in other industries. Chart "A" shows such a control applied to a Jenkins Pressure still furnace. Note that this is a 2 record multiple type of instrument, recording each side of the furnace. Two burners are used, each with a control valve connected to this 2-record multiple. This permits not only the control at a desired point, but also balancing of the two sides of the furnace.

Some of the limitations of the "off and on" controls are:

(1) If the thermocouple is located in the oil outlet, to keep the temperature fluctuation with in narrow limts, there is required considerable difference in adjustment between the open and closed positions of the valve. This mean: (a) The furnace masonry and tubes are subjected to an alternate heating and cooling, which, if too great, is not conducive to long life or minimum repair. (b) The danger of over heating a tube is material. (c) The possibility of the oil temperature "riding high" for a short period is increased, particularly, if the rate of charge is temporarily decreased, due to the slowing of the pump. (d) In the case at a cracking still this "riding high," or peak temperature, results in a greater deposition of coke.

(2) If the thermocouple is located directly in the combustion chamber, as in chart "A," to keep the temperature fluctuation within narrow limits, there is required to a lesser extent the same difference between the open and closed position of the fuel supply valve. To a lesser extent, the same undesirable characteristics are possible.

(3) In too many cases, whether the thermocouple is located in the oil outlet or combustion chamber itself, it is practically impossible to introduce the proper amount of air for good combustion, for both positions of the control valve. This results oftentimes in an insufficient amount of air for the open position of the fuel valve, with the resulting increased deposit of soot on the tubes. Such increased soot deposit, as you all appreciate, means a decrease in the rate of heat transfer, resulting in waste of fuel.

Some of you gentlemen have seen such "off and on" controls applied to furnaces, or have them in your own plant. You have appreciated the limitations and value of such "off and on" control. You have used them, principally, to minimize the human factor although your firemen may have become what you regard as proficient in controlling your furnace and still temperatures.

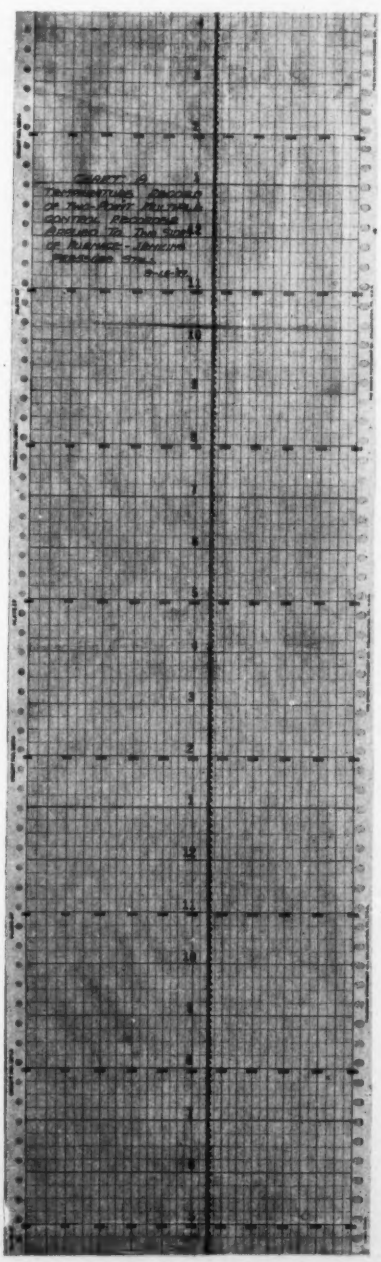
Is the evolution of furnace control to stop here?

In order that you may appreciate the possibilities and permanent value of furnace controls, I have drawn a graph on a large scale, of an oil outlet temperature record on a Cross Cracking Still.

Graph No. 1 depicts a not unusual condition in the oil temperature of a Cross Cracking Still which is hand fired. Note that the scheduled operation temperature is 890 degrees. Note that the temperature follows this schedule fairly closely, except at one point it is allowed to get up to 920 degrees F. This temperature of 920 degrees F. is well within the zone where excessive coke deposits begin. Note at one other point that the temperature is allowed to drop to 865 degrees. Such a drop in temperature means a loss in yield of at least 5 per cent.

The Off Day

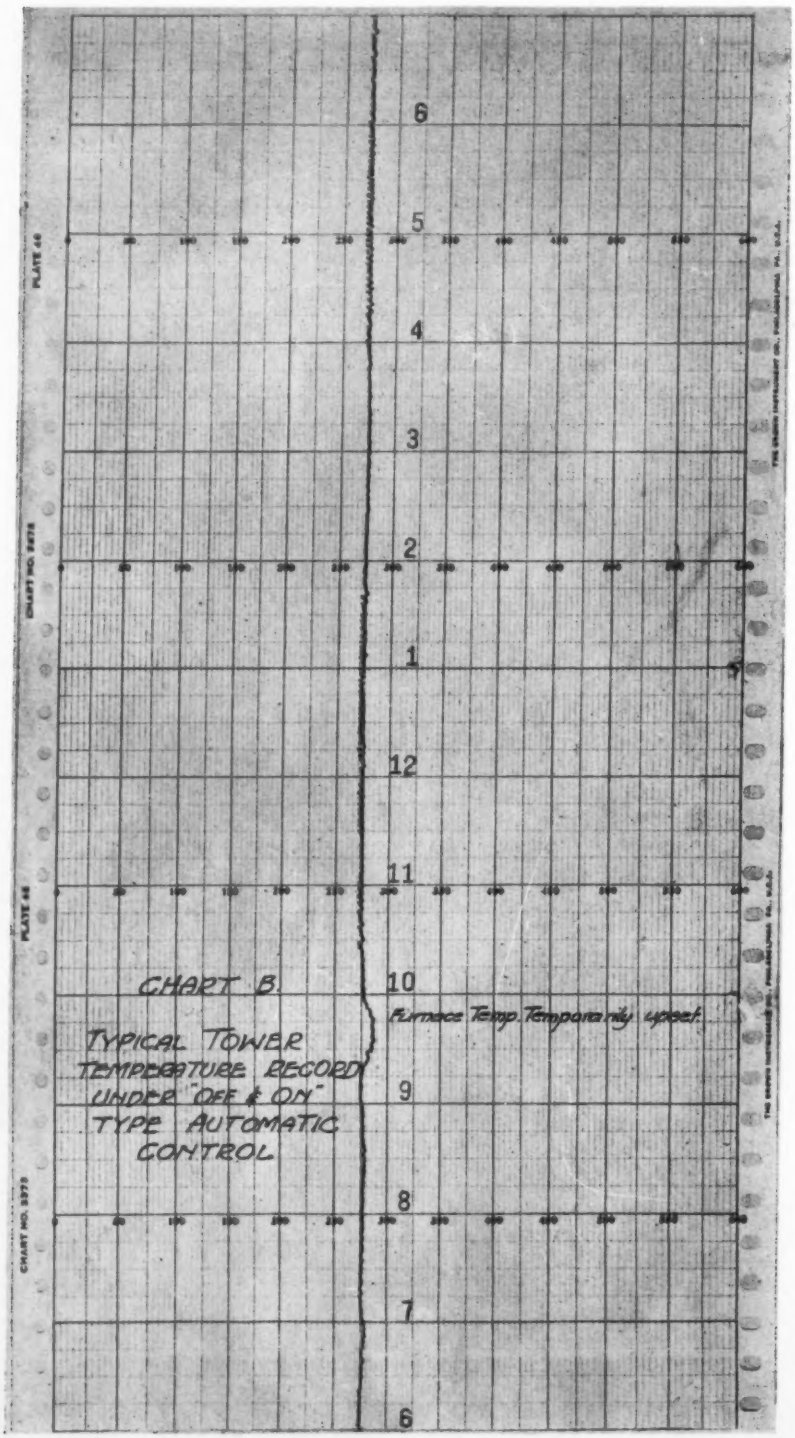
You gentlemen know that it is possible for your firemen to obtain such profi-



*Presented at technical meeting of the Western Petroleum Refiners Association, Hotel Lassen, Wichita, Kansas, October 11, 1927.

ciency that they can obtain a straight line oil outlet temperature for a majority of the time. Whether it is due to the "human equation, "or other causes, there are periods in every fireman's life, when he does not give the still the attention he should. Assume that the fireman's "off day" occurs only one out of 20, think what it would mean, if on that day he allows your yield to drop to 5 per cent, or allows your coke deposit to increase for an appreciable portion of that day. On the basis of the average yield in a small plant per day, the preventive loss would be sufficient to pay for the automatic control the first day.

The above statement does not take into consideration that a cracking still operated at as high an oil temperature as possible, without undue disposition of coke, is assumed to give a better gasoline product of anti-knock qualities. An automatic furnace control, by eliminating the human equation, can permit you to operate consistently nearer the danger point, where excessive coke deposit begins, than you would dare to do with hand control. This makes it possible for you to get a better quality product than by hand control.



In case of a crude pipe still, you can appreciate from your own knowledge that: (a) A drop in the oil outlet temperature materially affects your yield. (b) An excessive oil temperature is apt to overload your refractionating equipment. If an automatic control can assist you in eliminating these ill effects of the human equation—even though they occur only one day out of 20—it is worth while.

I have outlined the limitations, in my opinion, of automatic controls for furnace temperatures as they now appear on the market. What type of mechanical and electrical design in automatic control should you expect to eliminate the above limitations? What is the best method of controlling a furnace? Shall it be directly from the oil outlet thermocouple actuating the furnace fuel supply, shall it be from the furnace thermocouple actuating the furnace fuel supply, or shall it be the combination of both?

Desirable Control

Based upon the observation from extensive tests and development work on automatic furnace control made during the past several years, it is my opinion that the most desirable furnace control should be made up as follows:

(1) A control pyrometer actuated from thermocouples in the combustion chamber should vary the amount of fuel to the furnace burners to give a constant furnace temperature regardless of oil "throughput."

(2) It is desirable to have an auxiliary control pyrometer actuated from the oil outlet temperature, or an intermediate point between the oil outlet and oil inlet. This should arbitrarily vary the rate of charge to iron out small fluctuations in the oil outlet temperature. This is particularly desirable where it is impossible to maintain an absolute constant rate of charge because of the varying speeds of the charge pumps.

Varying the rate of charge to iron out small fluctuations in the oil outlet temperature, is suggested because the response is much more rapid. It has been shown that in a pipe still of average size and thermal capacity, varying the rate of charge will effect the oil outlet temperature about three times as fast as varying the furnace temperature.

Such auxiliary control would also serve to eliminate other temporary factors likely to upset the oil outlet temperature, such as change in inlet oil temperature, a rain storm, etc.

(3) Instead of the furnace control described in No. 1, and auxiliary control described in No. 2, a control pyrometer actuated from a thermocouple located in the oil outlet or an intermediate point between the oil outlet and inlet, can be used to vary directly the fuel supply to the furnace burner. This type of control is best adapted to small units having high rates

of charge with resulting less amount of lag.

The mechanical and electrical design of controls described above should be such as to give the following characteristics:

(1) Maximum sensitivity.

(2) Adjustment of fuel burners, at frequent intervals but in small increments.

(3) Adjustments proportional to amount of temperature divergence from the desired control point.

(4) Capacity of the instrument to "ease off" any adjustment at the instant temperature fluctuation stops and begins to recede toward the control point.

(5) Means of adjusting such capacity to recede in accordance with the lag present in the unit being controlled.

A control having the above characteristics would approximate the best manual control of an intelligent operator with his hand constantly on the control valve and his eye on the pyrometer. There would be no alternate heating and cooling of the furnace masonry and tubes or an excessive soot deposit due to incomplete combustion. Fuel economy would be the maximum.

I believe you will agree with me, that with an instrument so designed, an automatic control for furnace temperatures is desirable. It would eliminate the losses due to the human equation in hand operation.

I am very glad to state, gentlemen, that such a control is about to be placed on the market.

Tower Application

To date, automatic controls for fractionating towers, have been of two classes: The "off and on" type, and the so-called throttling type. Both pyrometers and thermometers, working on the principle of the "off and on" adjustments of the reflux valve, have been applied to towers. Heretofore, the throttling type has been confined to a thermometer control using compressed air as a source of power.

To apply successfully automatic temperature controls to the towers, several factors must be taken into account.

(1) The thermal conductivity of the vapors at the outlet of the tower and therefore the rate of heat transfer is relatively small.

(2) The velocity of the vapors in the tower and leaving the tower, is high.

(3) The ability of the vapor, coming up through the fractionating column, to "reflux" is a function of the vapor pressure and a change in vapor pressure, particularly a temporary or pulsating change in vapor pressure. Minute changes in vapor pressure have material effect.

(4) Fractionating columns as made today have a considerable thermal capacity.

The automatic temperature control which is going to prove to be the best adapted to fractionating towers must have maximum sensitivity. It is very important, especially in view of the low rate of heat transfer and high gas velocity, that the control, not merely record the mean temperature between minute fluctuations, but that it have sufficient sensitivity to pick up the trend of temperature, in the minute stage, where such trend is forming. If such trend of tower temperature is used as the basis of tower control, and not the mean temperature of minor fluctuations, a more consistent vapor temperature is possible. The reason for this is that the tower is not allowed to gather "momentum," so to speak, as it would if the control were actuated from the mean of tower temperature fluctuations. It too often happens that if a tower is allowed to gather "momentum," even for such a short interval of time, the tower temperature is apt to go off on a tangent, which would require hours to bring it back into balance at the desired temperature.

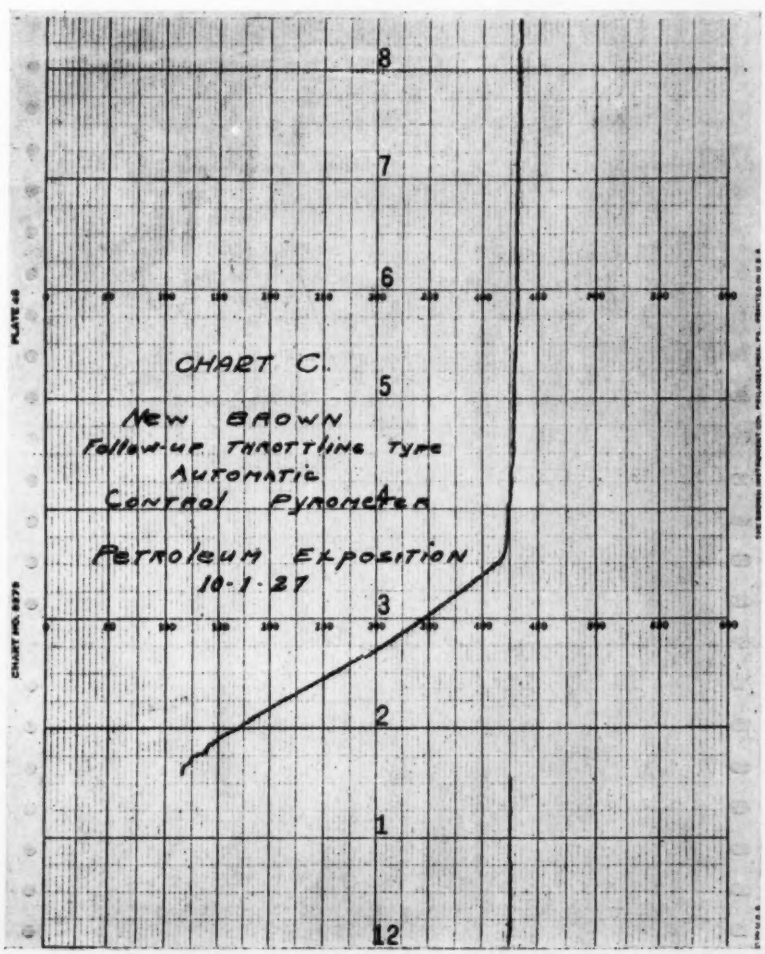
Therefore, the fundamental requisite of a satisfactory tower control is to pick up the trend of tower temperature at its minute stage.

It follows, therefore, that basicly, the pyrometer is the best adapted instrument for tower control, as compared with the thermometer, whether gas-filled vapor tension, mercury filled, or electric resistance type.

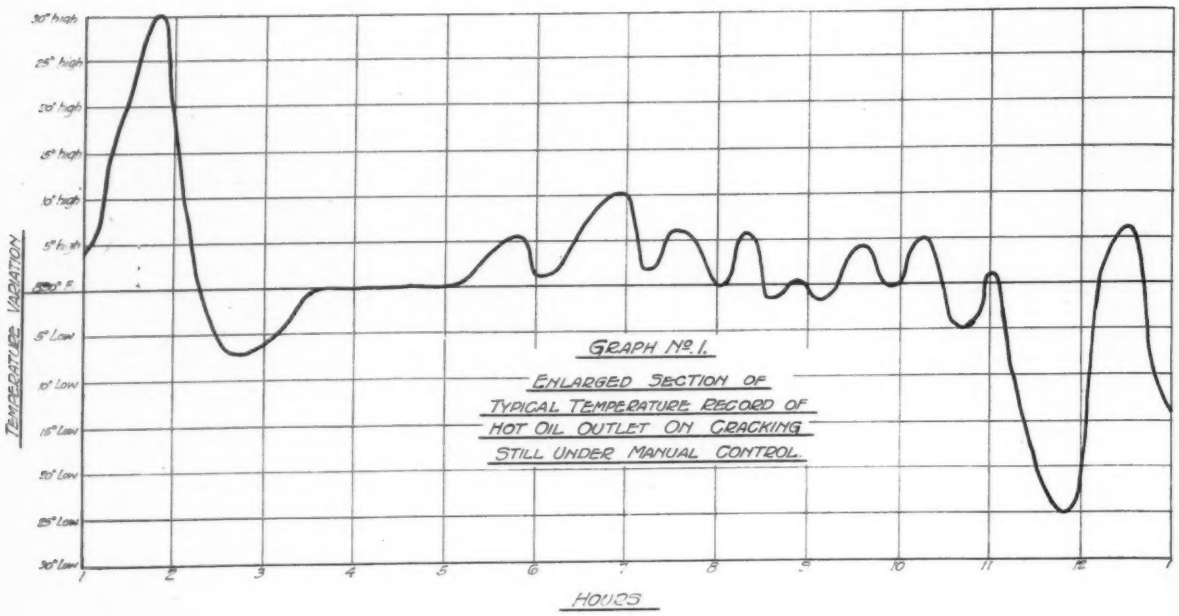
The reason for this should be readily apparent by comparing the sensitive portions of a pyrometer and thermometer. The thermocouple, the sensitive portion of a pyrometer, can be made of very fine wire, 25 gauge or less. It can be placed so that it touches the bottom of a thin walled well made of high thermal conductivity material—such as aluminum bronze. The bulb, the sensitive portion of a thermometer, must be much larger in size and placed in a second well. *In the case of the thermocouple, the effective thermal capacity is almost negligible as merely the tip end of the thermocouple must be brought to the temperature to be measured.* In the case of the thermometer, the mass, and therefore, the thermal capacity is much greater. The heat from the tower vapors must travel through the outer well, the separating film between the well and the bulb, and thence into the liquid or gas inside the bulb. *This entire mass must be brought to the temperature to be measured.*

Catching Small Losses

There is no better illustration of the sensitivity of the pyrometer than that of applying a match to the thermocouple. Some of you gentlemen know that a match contains a thermo potential of from 1200-2000 degrees F. If you attempted to register that potential on a thermometer, you would do well to get 300 degrees. I have brought with me a standard indicating pyrometer and a fine wire thermocouple similar to that used in a tower. Please note that the sensitivity of the pyrometer is sufficient to pick up a temperature change by merely passing the



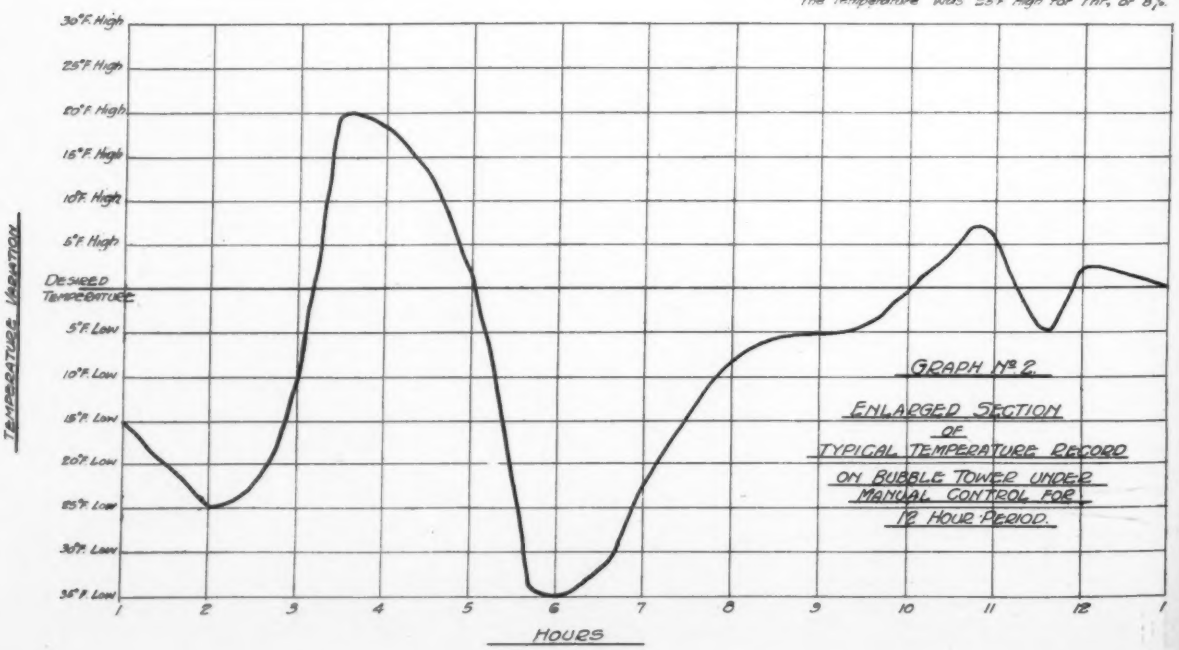
NOTE:-
Of total period of 12 hrs, the temperature was 10° low or more for 1½ hrs, equivalent to 10½% of total period. The temperature was 30° high for ½ hrs, or 3% of total period.



GRAPH No. 1.

ENLARGED SECTION OF TYPICAL TEMPERATURE RECORD OF HOT OIL OUTLET ON CRACKING STILL UNDER MANUAL CONTROL.

NOTE:-
The Total Period is 12 hours, or 100%.
The Temperature was 20°F. High for ½ hrs, or 3%
The Temperature was 15°F. High for 1 hr, or 8⅓%
The Temperature was 10°F. High for 1½ hr, or 11⅞%
The Temperature was 5°F. High for 2 hr, or 16⅔%
The Temperature was .°F. Low for 6 hr, or 50%
The Temperature was 10°F. Low for 5½ hr, or 45⅞%
The Temperature was 15°F. Low for 5 hr, or 42%
The Temperature was 20°F. Low for 5½ hr, or 45⅞%
The Temperature was 25°F High for 1 hr, or 8⅓%



GRAPH No. 2.

ENLARGED SECTION OF TYPICAL TEMPERATURE RECORD ON BUBBLE TOWER UNDER MANUAL CONTROL FOR 12 HOUR PERIOD.

match back and forth under the thermocouple. If I leave the match under the thermocouple, I can easily read 1200-2000 degrees, the potential of the match.

Another requisite of a satisfactory automatic temperature control for towers is that any adjustment in the reflux which it makes, must be done gradually. The "off and on" type of tower control permits: first, a large amount of reflux, and second, a small or even no amount of reflux to be emitted at the top of the tower. This is commonly described as the "feast and famine" type of control.

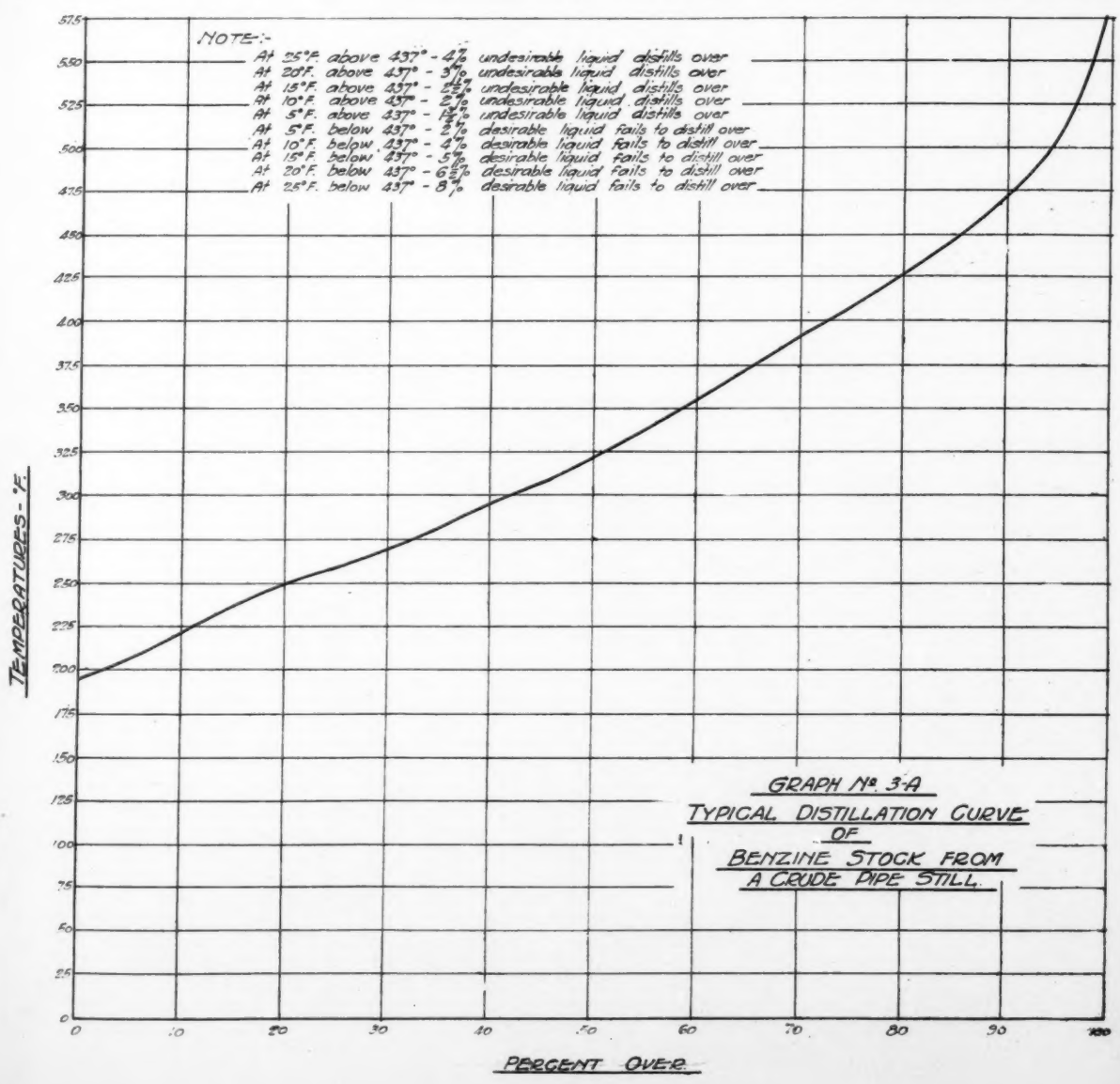
Such "feast and famine" in the reflux is apt to cause a decided cooling followed by the heating of the vapors coming up through the fractionating column. This results in an accompanying change of the vapor pressure in the different parts of the fractionating column. This means that the lighter ends are being pulled down and held in entrainment by the heavier molecules condensing into liquid form. In the case of the "famine," the heavier ends are allowed to go over when they should have been thrown back. To reduce this ill effect, the amount of liquid in the trays has been increased by tower designers. This increases the thermal capacity and in consequence the lag.

You gentlemen are probably well acquainted with the fact that it is possible for you to run 25 degrees F. high in your tower temperature followed by 13 degrees to 20 degrees F. low as compared with that temperature which will give you 437 end point and still have the distillation curve of the sample of your product from the run down tank check at 437 end point. It has been stated that this paradoxical condition is true only because your laboratory distillation test is made upon a comparatively small sample. The heavier ends remain as a vapor in the bottom of the neck of the distillation flasks and do not affect the thermometer. In these days when the small losses are being considered, it is desirable to eliminate that small amount of dilution and thus increase the anti-knock qualities of your product. Suppose this dilution equals only 1 per cent. That is only a small part of a 100 c.c. sample, but in a month's run it is material. Automatic tower control as described later by better attention to this last 10 per cent of fractionation than is possible by hand control, can keep out this heavier end dilution.

Chart B, shows a typical pyrometer tower control of the "off and on" type. The record is consistent but not as satisfactory as can be produced by a tower control as described later. The dilution by heavier ends is less than by hand control but still can be made more satisfactory.

We have the general statement made that an automatic control by eliminating the human equation in tower manual control can decrease the per cent of preventable loss in yield.

To give you a tangible idea of what these losses can amount to, I have taken an average tower temperature record which has been manually controlled and plotted a portion on a larger scale. Graph No. 2, please note that for 12 hours, the


NOTE:-
At 25°F. above 437° - 4% undesirable liquid distills over
At 20°F. above 437° - 3% undesirable liquid distills over
At 15°F. above 437° - 2½% undesirable liquid distills over
At 10°F. above 437° - 2% undesirable liquid distills over
At 5°F. above 437° - 1½% undesirable liquid distills over
At 5°F. below 437° - 2% desirable liquid fails to distill over
At 10°F. below 437° - 4% desirable liquid fails to distill over
At 15°F. below 437° - 5½% desirable liquid fails to distill over
At 20°F. below 437° - 6½% desirable liquid fails to distill over
At 25°F. below 437° - 8% desirable liquid fails to distill over
TEMPERATURES - °F.
PERCENT OVER
GRAPH No. 3-A
TYPICAL DISTILLATION CURVE OF BENZINE STOCK FROM A CRUDE PIPE STILL

total number of hours of the run, the temperature fluctuated as follows:

1/3 hour	20° high or 3% of total time
1 hour	15° high or 8% of total time
1¼ hour	10° high or 11% of total time
2 hour	5° high or 16% of total time
6 hour	5° low or 50% of total time
5½ hour	10° low or 45% of total time
5 hour	15° low or 41% of total time
2½ hour	20° low or 20% of total time
1 hour	25° low or 8% of total time

By comparing the above table, which might easily be the fluctuations of a tower under manual control on a crude still or a pressure still, with the distillation curve of a benzine stock run above 437 end point or a pressure distillate, you can note the per cent loss in yield due to carrying the temperature too high or too low. Such distillation curves are shown as graphs No. 3A and 3B. These curves are from stocks in which the fractionation has been only average, but typical.

From this you will see that if the tower temperatures were held with 50 per cent less fluctuation, the increase in yield would be sufficient to buy several automatic controls.

The type of mechanical and electrical design of the automatic control best adapted for towers is not unlike that described for furnace control. You can readily appreciate that a tower control having the characteristics described above for furnace control would give you maximum sensitivity with the elimination of the "feast and famine" and the resultant partial pressure pulsations through the fractionating columns. You could expect the yield to be greater. You could expect to balance your entire unit and keep it balanced with greater ease.

You may be interested to know that at the International Petroleum Exposition at Tulsa we had such a control working for a small shell still unit. I have here for your inspection a sample of the record produced on that still designated as chart C. Please note that the temperature is brought up in a gentle curve from the atmosphere temperature and that the temperature is maintained at that point with the absence of hunting or "feast and famine."

Now, that it is possible to make a control pyrometer of the proportional follow up type, it is safe to prophecy that the tower controls in the future will increase and the one which really will control, will be the electric pyrometer.

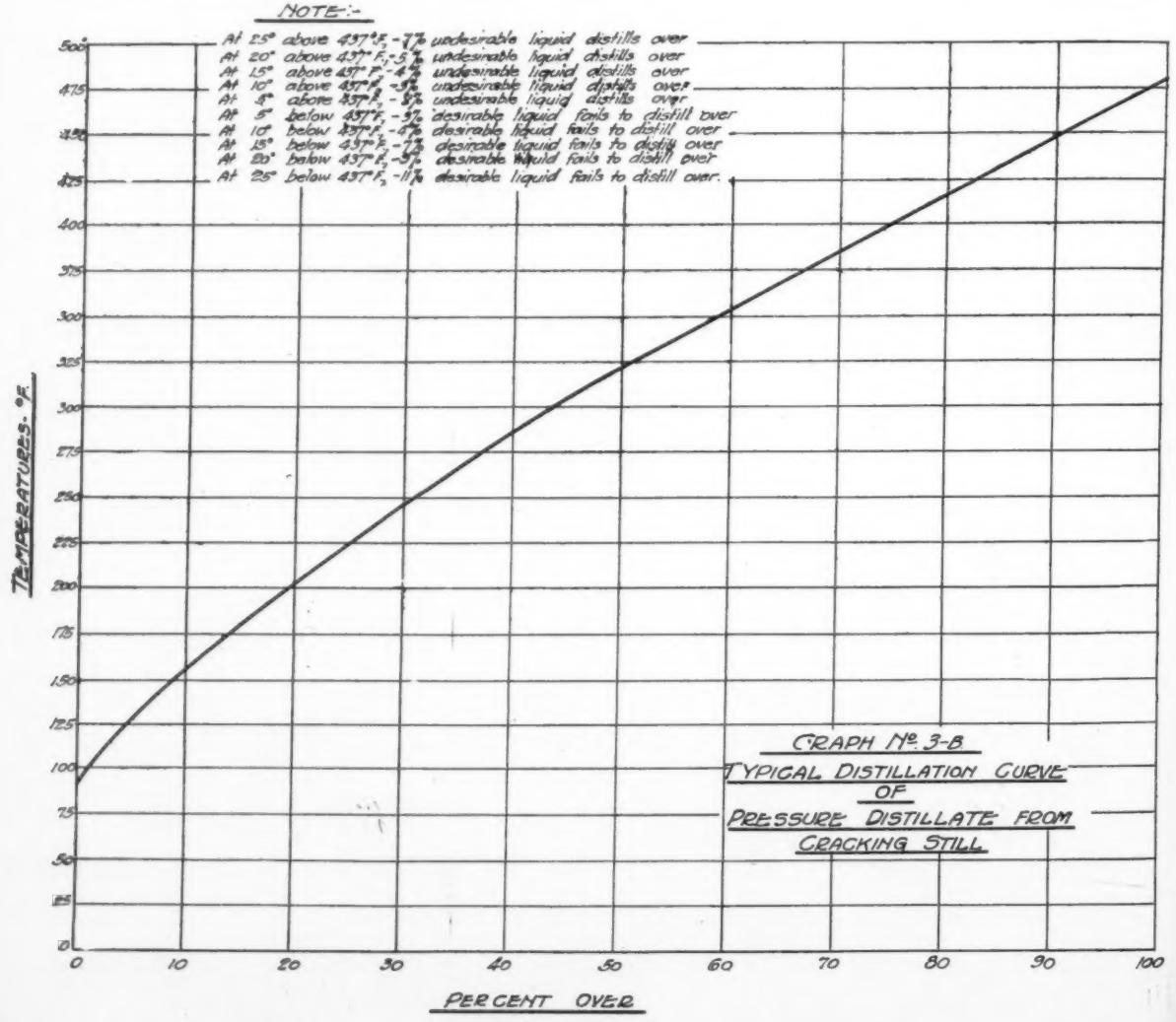
I wish to acknowledge the assistance of Dr. Cross of the Kansas City Testing Laboratories in confirmation of the data on distillation included above.

Revised Rate Decision Unsatisfactory

Tulsa, Okla.—It seems to be a matter of one battle after another in the "Mid-Continent Oil Rates, 1925," on which a revised decision was handed down by the Interstate Commerce Commission, October 12, following decision October 4.

The revised decision followed efforts of Oklahoma refiners in group 3 to prevent the previous decision, which gave Kansas refining points a differential of two and more cents to certain points. By the revised decision, Central Kansas refining points are put in Group 3 with Oklahoma refining points. Group 2, thereby becomes a small part of Southeastern Kansas having refiners at Coffeyville, Chanute and Humboldt, as well as Joplin, Missouri and Quapaw, Oklahoma.

The decision has met with general disfavor, except perhaps in the refining centers of Southeastern Kansas. All that can now be said definitely about the whole rate controversy is that another tariff has been fixed and that it will be opposed.


NOTE:-
At 25° above 437°F. - 7% undesirable liquid distills over
At 20° above 437°F. - 5% undesirable liquid distills over
At 15° above 437°F. - 4% undesirable liquid distills over
At 10° above 437°F. - 3% undesirable liquid distills over
At 5° above 437°F. - 2% undesirable liquid distills over
At 5° below 437°F. - 3% desirable liquid fails to distill over
At 10° below 437°F. - 6% desirable liquid fails to distill over
At 15° below 437°F. - 7% desirable liquid fails to distill over
At 20° below 437°F. - 9% desirable liquid fails to distill over
At 25° below 437°F. - 11% desirable liquid fails to distill over.
TEMPERATURES °F
PERCENT OVER
0 10 20 30 40 50 60 70 80 90 100
GRAPH No. 3-B
TYPICAL DISTILLATION CURVE
OF
PRESSURE DISTILLATE FROM
CRACKING STILL

Length 41 feet. Inside diameter 7 feet. Wall thickness 3¾ inches. Weight 147,900 pounds.

Safety and Savings by Smith

Because of the completeness and magnitude of the A. O. Smith Corporation's equipment and plant, Smithsteel Cracking Vessels can be obtained in less time than cracking stills made by other methods.

Size of Stills

Smithsteel Cracking Stills can be built to any diameter and length within transportation limits—and in any wall thickness within steel mill capacity.

Safety

Smithsteel Cracking Stills have a continuous record of successful operation in the field under the most exacting and varied conditions.

Every Smithsteel Vessel is tested not only with reference to operating conditions but is subjected to pressures which may be three or four times as great as those which the vessel will encounter in actual operation. These tests are invariably made in the presence of purchasers' representatives.

Cost

Smithsteel Cracking Stills do cost more than vessels made by some other methods. The extra cost is the price of safety.

347 STILLS

—accurate to 1-8 of an inch in diameter in lengths varying from 32 to 46 feet

To date, the A. O. Smith Corporation has built 347 cracking stills which provided for operation of revolving coke removal apparatus. These stills vary less than ⅛ of an inch in diameters from 5 feet to 6 feet and in lengths from 32 feet to 46 feet.

This accuracy was not secured by special means. It is the standard of accuracy to which *all* Smithsteel Cracking Stills are built.

This accuracy is equally important for any process, as it permits the preparation of pipe and superstructure in advance with certainty that the Smithsteel Cracking Still will fit exactly.

A. O. SMITH CORPORATION, *Milwaukee, Wisconsin*
Oil Field Products Division Los Angeles

Mention Where You Saw the Advertisement

New Type of Fractional Condensing Column

THE object of distilling petroleum is to separate the crude into various fractions containing compounds having boiling points that are very close to each other. Crude petroleum consists of hundreds of closely related compounds, the boiling points of which range from ordinary temperatures to very high temperatures. As the oil is first heated in a still, those compounds with boiling points lower than the temperature of the total will be distilled off; but at the same time they will be accompanied by a relatively small percentage of compounds boiling just a little higher. Dephlegmating, or fractionating, towers or columns are used in connection with the operation of stills to remove these compounds of higher boiling point, and thus obtain a cut or fraction consisting of compounds with boiling points that are relatively close together.

The cuts or fractions that are made in the distillation of crude oil are chosen arbitrarily. The range of boiling points in any cut may be either very close or very wide. This will depend upon the nature of the oil, the efficiency of the apparatus or the physical characteristics wanted by the operator in that particular cut.

Most of the older types of dephlegmating towers consisted of vertical cylinders filled with some material that presented a large surface to the oil vapors as they passed through it. Some of the more common forms of material with which such towers were frequently filled were crushed stones, broken-up tiling or horizontal metal plates; but, within recent years, the so-called "bubble" type of dephelgmating tower is being used more extensively. In either case, the hot oil vapors from the still enter the tower near the bottom, work their way up through the small spaces between the pieces of baffling material or, in the bubble tower, between the liquid layers and then leave the tower at the top.

Common Practice

The principle of such operation is that the tower, being of necessity cooler than the still, causes those compounds of high boiling points to condense out. The baffling material also tends to remove the mechanically entrained liquid from the oil vapors. As a result of this, the hot liquid slowly trickles down over the baffling material counter-current to the incoming vapors, which slowly bubble up through the hot liquid, and thus the higher boiling-point constituents are almost completely removed. The liquid that drains out at the bottom of the tower either may form one of the cuts resulting from the distillation, or it may be returned to the still or it may be circulated over the top of another tower.

Many refiners, when re-running their lighter distillates in continuous operation, charge such distillates through the fractionating tower of the first still of the battery that is operating in such a manner, thus effecting both a heat economy and an additional efficiency from the fractionating tower. An even closer fractionation is possible if the liquid that is pumped in at the top of the tower is, in its chemical composition, more nearly like the vapors that are rising in the tower.

The oil vapors from the still usually pass to dephlegmating towers, which are in part fractional condensers, and thence through water-cooled, cast-iron coils placed in steel condenser boxes.

Fractional condensers may be either of the aerial type, or of the water-cooled type, or they may be simply vapor heat exchangers. In all cases, the purpose of fractional condensation is to obtain a closer cut—that is, hydrocarbons with boiling points more nearly alike—and thus reduce to a minimum the quantity of oil that is necessary to re-run.

Types of Condensers

The purpose of a condenser is to cool the vapors coming from the still to such a point that almost all the vapors are converted into liquid. The problem of ascertaining how much condensation surface is necessary—that is, the size of the condenser—involves a determination of the quantity of heat that the condenser must remove, and the amount of cooling surface and cooling fluid (water) necessary to remove this quantity of heat. This is done very simply by following the natural laws and conditions that control condensation.

The three main types of condensing apparatus in general use are as follows:

1. Continuous submerged coils.
2. Parallel submerged coils.
3. Shell and tube apparatus.

An example of the shell-and-tube type of fractional condensing column that is finding more and more extensive usage in the oil industry is the Leach fracto-condenser. This is essentially a condensing column designed in such a manner as to separate the condensate into several fractions and making use of the feed stock as a cooling medium for the recovery of a large amount of process heat.

In its construction the Leach fracto-condenser consists of an outer shell of cast-iron or steel plate, of circular section, approximately 10 feet in height and five feet in diameter. Within this shell are a number of tubes calculated to balance velocity of flow and possibility of fouling. These tubes extend vertically from a heavy base or channel casting and are expanded into several floating heads at the top of the condenser to relieve stress due to uneven expansion and contraction. This method of construction precludes the possibility of damage when using cooling media of widely-separated temperature. The cooling medium or media passes through these tubes, the vapor condensing upon their outer surface.

The channel casting referred to above contains a tube sheet into which the tubes are rolled. The top of this casting has integral basins formed upon it in which the distillate fractions collect and from which they are drawn through bleeder pipes. The tubes extend through the casting and communicate with the compartments at the bottom from which the cooling media are controlled.

Fractional Control

On the lower flange of the channel casting are a series of covers, used to control the path of the cooling medium. Rearrangement of these openings makes it possible to provide for the use of several combinations of cooling effects without danger of contamination through intermingling. The fractional control of the cooling media accomplished in this manner aids in condensing the vapors into the fractions desired. These fractions are then drawn off from a series of bleeder pipes extending from the condensate basins. The Leach fracto-condenser, therefore, lends itself admirably to the distilling operations of refineries, since each fraction can be sampled and directed to a separate tank, materially reducing treating and re-running operations.

Within the condenser shell, and between the blocks of tubes, are several vertical baffles to direct the flow of the vapor and to create several compartments for the fractional condensation of the distillates in the vapor. The temperature of these various compartments may be controlled by adjusting the flow of the cooling medium or by use of two or more cooling media. In this manner, the temperature of the vapor is progressively lowered as it travels through the successive compartments accomplishing a separation of the distillate into several fractions. The baffles are carefully fitted to avoid short-circuiting of the vapor and are indexed upon the basins at the top of the channel casting.

Design to Reduce Corrosion

The design of the Leach condenser has been carefully planned to reduce or to eliminate corrosion within the shell. The liquid spaces are constructed of close-

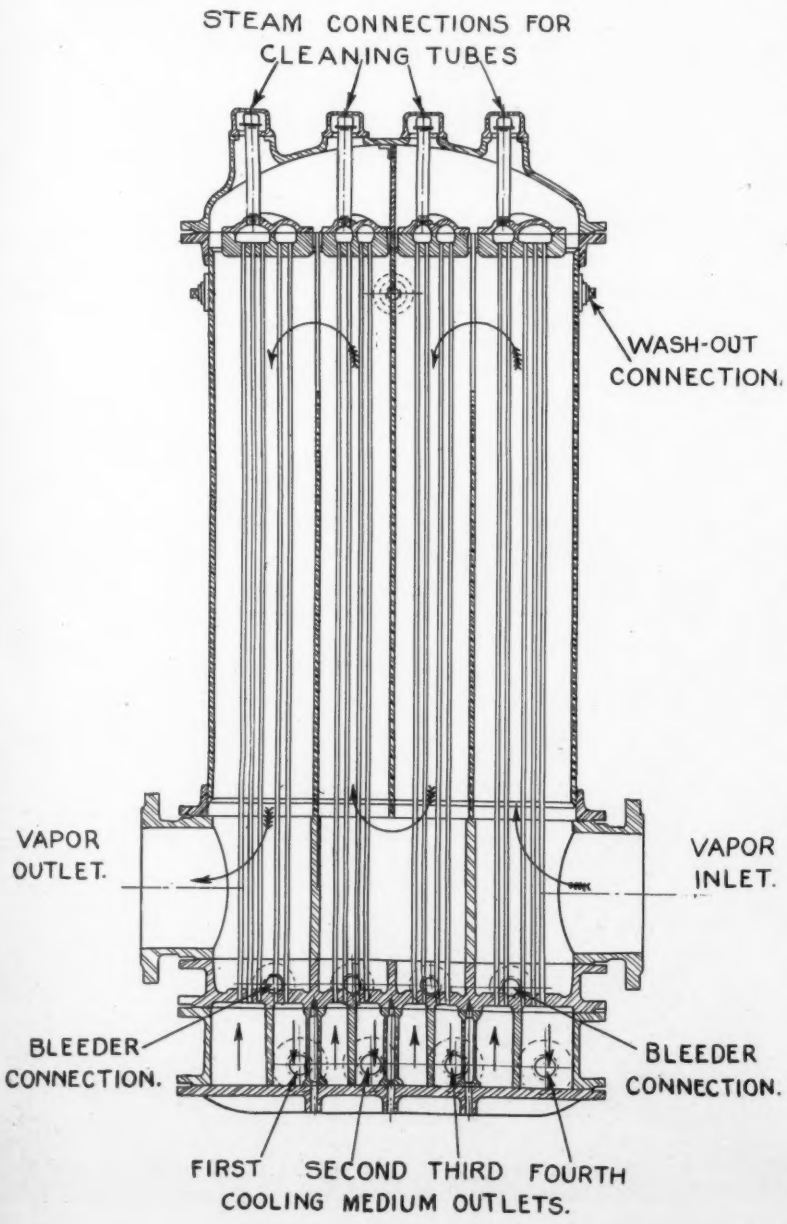
grained cast iron. The tube sheet in the channel casting is provided with bosses projecting upward, which divert the downward flow of the condensate away from the lower ends of the tubes. The shell and shell baffles, because of their vertical position, rapidly drain any distillate deposited on their surface. All gaskets are of asbestos, specially bound to withstand the action of solvents and high temperature.

The efficient transfer of heat between vapor and cooling medium is a function of both the film thickness of the cooling medium and the distance of travel of the vapors. Small tubes are used to increase the velocity of flow and decrease the film thickness. The contraflow design and the long travel are both contributory to a low outlet temperature of any non-condensable material, with consequent maximum heat transmission from each bank of tubes.

The Leach fracto-condenser is made and sold under a license agreement which the manufacturer has with the inventor, C. H. Leach of Boston, Mass. It is protected by U. S. Patent No. 1,604,179, granted October 26, 1926, and also by patents issued in Great Britain, the Dominion of Canada, the Argentine Republic and other foreign countries.

Supplements Bubble Tower

Concerning the application of this fractional condensing column it might be mentioned that it is *not* designed to eliminate or to supplant a bubble tower, its function therewith being merely to reduce the work required from a bubble tower and to permit the use of a fewer number of trays.



In view of the fact that the lower trays of any bubble tower are little more than heat exchangers, wherein the greater part of the work is done by the several upper trays; furthermore, efficient recovery of heat from the top of the tower being impossible, since the temperature difference is so slight at this point—therefore, the manufacturers claim that employing a Leach fracto-condenser either behind or ahead (depending upon the particular conditions) of the tower allows a lower reflux ratio, lower still temperature, greater tower capacity, fewer number of trays, high heat recovery and condensation of any light products entrained in the apparatus.

The Leach condenser is suitable for use on both vacuum and pressure stills. The liquid spaces will withstand any vacuum and working pressures up to 1500 pounds per square inch. Vapor spaces provide for pressures up to 150 pounds gauge reading and for any degree of vacuum. The vapor passages and vapor inlet and outlet are of sufficient area to reduce back pressure on the still and to handle successfully the increased volumes of vapor on distillations under reduced pressure.

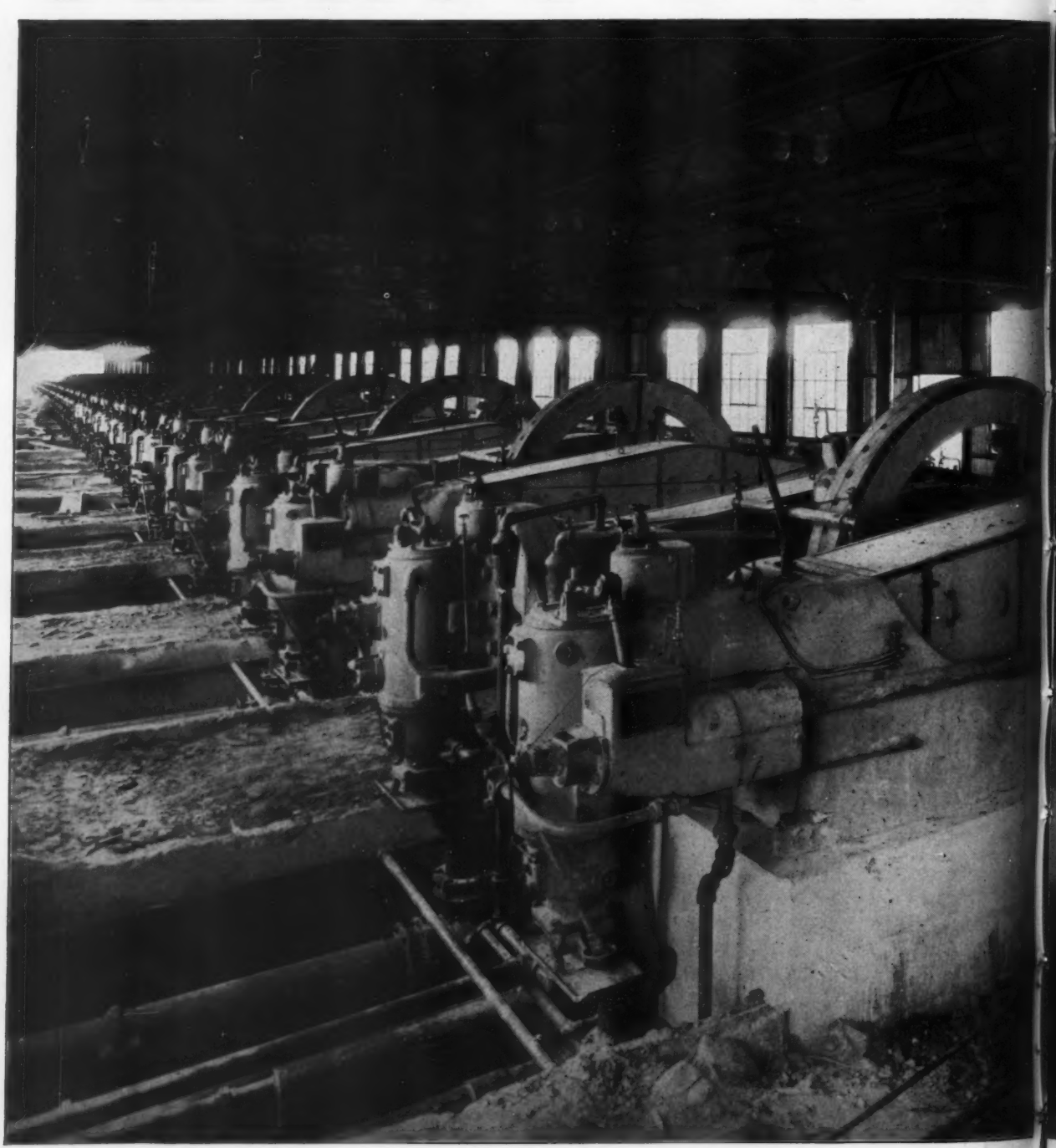
Covers placed on the top of the condenser provide easy access to the tubes for cleaning, repairing or inspection without disturbing cooling medium, bleeder or vapor connections. These covers also allow for re-tubing with minimum inconvenience and cost. A more thorough cleaning of the apparatus can be accomplished by removing both floating head and base carting covers, whereupon each tube may be cleaned or replaced without disturbing any of the other tubes. Blow-off plugs in the head allow for a steam connection to be made to any bank of tubes, should fouling make it necessary.

Figure I shows the design of this fractional condensing column as described in this article, which column, as previously mentioned, is being used more widely in oil refineries on both vacuum and pressure stills, running either continuous or batch.

Gulf Building Line to Handle Yates Oil

San Angelo, Texas.—Gulf Production Company will provide a market outlet for its future production in the Yates field, Pecos County, through the construction of an eight-inch pipe line to a tank farm and tank car rack on the Orient Railroad, between McCamey and Hurdle, a distance of about 25 miles. Materials have been shipped for the construction of this line promptly, and upon its completion the Yates field will have four eight-inch and one six-inch line in service. Illinois Pipe Line Company has an eight and a six extending to McCamey and Hurdle, and an eight-inch carrier to tank farm at Del Rio, while Humble connected the field to its West Texas system with an eight-inch line to Kemper station, Reagan County.

THIRTY-TWO



Mention Where You Saw the Advertisement

COOPERS IN A ROW

In one of the largest and most modern gasoline plants in the whole country the Sinclair Oil and Gas Company is installing thirty-two Cooper Type-80 twin engines. The photograph shows the plant under construction.

How unnecessary it is even to mention the many superior features of Cooper engines and compressors, when a company, after having turned to Coopers less than three years ago, chooses them for such an important station.

The C. & G. Cooper Co.
Mount Vernon, Ohio

Dallas, Texas **Tulsa, Okla.**

Los Angeles, Calif.

Oil Fuel Equipment Outstanding in Parco Generating Plant

NEARLY all refineries with an average daily crude capacity of 1000 to 1500 barrels, or better, find it more economical to generate their own electrical power than to purchase it from a public service company. Consequently, the subject of power plant construction is of interest to every refiner.

One of the most modern power plants, both in appearance and in efficiency, to be found in any oil refinery, is that constructed and in use at the Parco, Wyoming, refinery of Producers & Refiners Corporation. This power plant was built during the latter part of 1923, as part of the construction program involved in building the refinery. As the engineers responsible for the design of this power plant were men with a vast and diversified experience in this phase of work, having previously built plants in all parts of the world, the power house as constructed at Parco therefore represents all that is new and modern in such a unit.

Building Construction

The power plant equipment at this refinery is housed in the north wing of an L-shaped building, which was constructed to serve as a combined boiler and power house. The boilers and super-heater are located in the other portion (part comparing to the base of the "L") of the building and are set east and west, the front of the furnace boxes facing due south. The boiler house proper is 164 feet long by 45 feet wide; while the power house portion of the building is 55 feet long by 45 feet wide.

The building itself is of structural steel frame-work with brick walls, all brick being held together with white cement mortar. All flooring is of concrete. Gypsum blocks constitute the roof of the building.

The power house proper, as is the entire building, is especially well lighted: three windows, seven feet six inches wide, being provided on the west side and one of similar size on the north side. The windows are in two sections, one part being 15 feet 10 inches high, above which is a two-foot six-inch metal spandrel, and above that another window, five feet two inches high. All windows are fitted with suitable mechanical sash operators for ventilating the building. Entrance into the power house portion of the building is afforded through a door on the south end connecting with the boiler room and through a 10-foot wide outside door on the north end.

Seven boilers are set up in the boiler room of this building: three 265-H. P. Babcock & Wilcox boilers and four 500-H.P. Heine boilers. The former were originally purchased and set in place by Producers & Refiners Corporation; the latter, by the J. G. White Engineering Corporation when they took over the refinery construction work.

Oil Burning Equipment

The four 500-H.P. Heine cross-drum, water tube boilers have a total heating surface of 5004 square feet. They are arranged, as are the B. & W. boilers also, both for oil and gas for firing. Each Heine boiler is provided with a Foster super-heater, which was jointly designed and arranged for by the Power Specialty Company, builders of Foster super-heaters, and by the Heine Boiler Company.

A separately-fired Foster super-heater is also set up in the boiler house in the space between the three B. & W. and the four Heine boilers. This super-heater is capable of super-heating 50,000 pounds of steam per hour at 20 pounds pressure to a final temperature of 334 degrees F., which latter corresponds to a super-heat of 75 degrees.

Equipment purchased from Schutte & Koerting and installed as mechanical fuel oil burning equipment in use in connection with the firing of the four Heine boilers and the separately-fired Foster super-heater, permitting operation at from 100 to 200 per cent above rated capacity, consists of the following:

Sixteen wide range burner and fireclay cylinders, 15 inches I. D. for Heine boilers, capacity 60 gallons per hour.

One wide range burner and fireclay cylinder for Foster super-heater, separately fired, having capacity to burn 20 to 0 gallons of oil per hour.

Two two and one-half-inch duplex suction line strainers.

One two-inch discharge line strainer, duplex.

Two one and one-half-inch pressure relief valves.

Five oil pressure gauges.

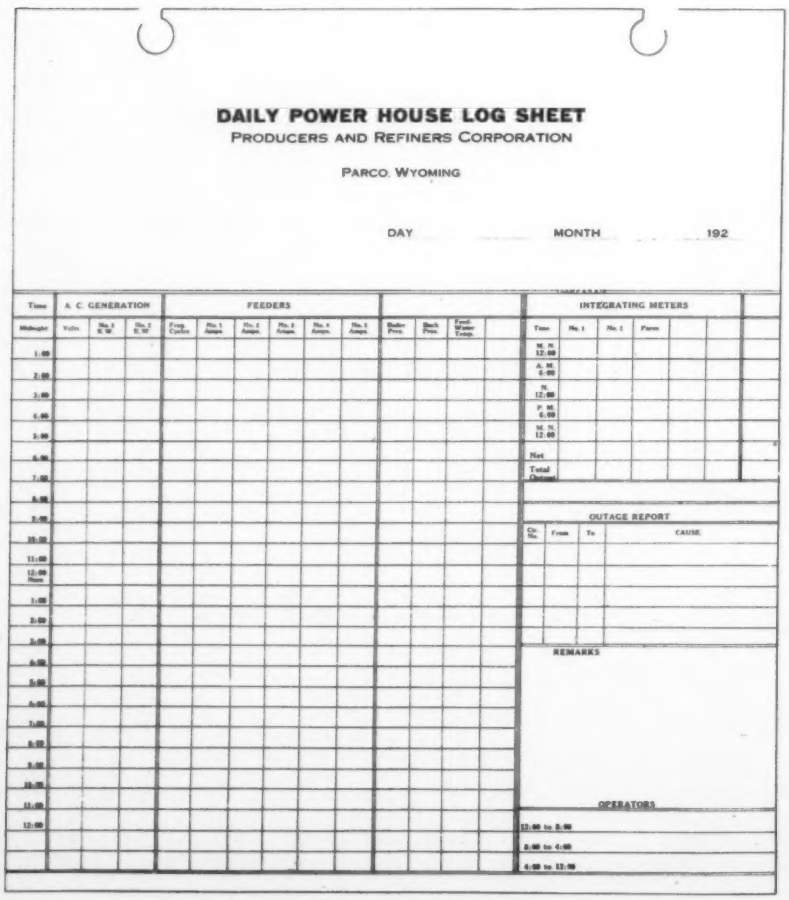
Five armored thermometers with socket for mounting on oil lines.

One oil flow meter for two-inch oil line.

One oil flow meter for two-inch oil line.

One oil-flow meter for two and one-half-inch oil line.

Two welded oil manifold headers fitted with extensions for eight burners



DAILY POWER HOUSE LOG SHEET

PRODUCERS AND REFINERS CORPORATION

PARCO, WYOMING

DAY MONTH 192

Time	A. C. GENERATION			FEEDERS										INTEGRATING METERS				
Midnight	Volts	No. 1 K.W.	No. 2 K.W.	Freq. Cycles	No. 1 Amps.	No. 2 Amps.	No. 3 Amps.	No. 4 Amps.	No. 5 Amps.	Boiler Pres.	Stack Pres.	Feed Water Temp.		Time	No. 1	No. 2	Paros	
1:00														N. N. 12:00				
2:00														A. M. 6:00				
3:00														N. 12:00				
4:00														P. M. 6:00				
5:00														M. N. 12:00				
6:00														Net				
7:00														Total Output				
8:00																		
9:00														OUTAGE REPORT				
10:00														Cir. No.	From	To	CAUSE	
11:00																		
12:00 Noon																		
1:00																		
2:00																		
3:00																		
4:00																		
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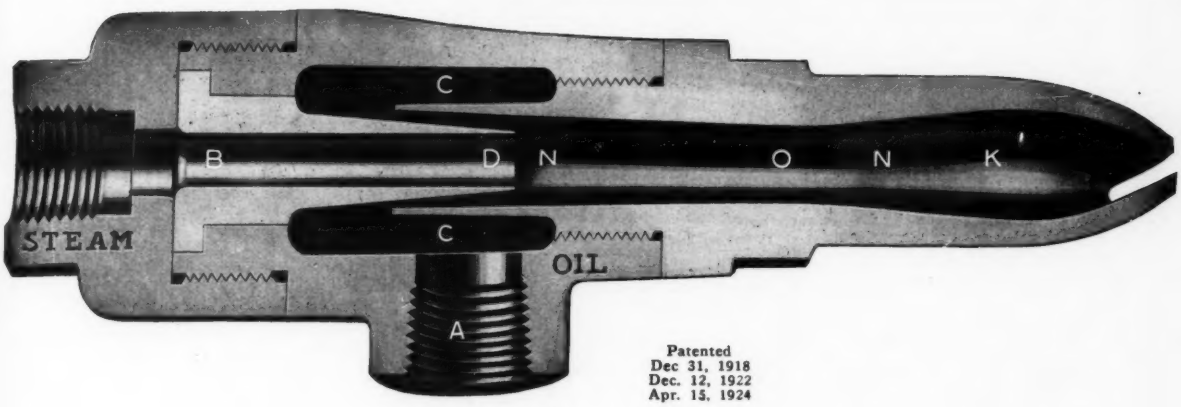
11:00																		
12:00																		
														REMARKS				

National Airoil Burners



Patented
Dec 31, 1918
Dec. 12, 1922
Apr. 15, 1924

For Power Plants and Stills and all Industrial Furnaces

NATIONAL AIROIL BURNERS
are internal atomizing burners—inside mixers —operating with either steam or compressed air; and burn as steady as a gas flame with any grade of fuel. Set your fire the way you want it, and it will burn the day through without watching or readjusting.

NATIONAL AIROIL BURNERS
will handle the heavy residuum from cracking stills without requiring continual removal for cleaning, an immense factor in economical plant operation.

NATIONAL AIROIL BURNERS
when operating under boilers will use less than one per cent of the steam for atomizing the oil. The old style steam atomizing burners use from three to seven per cent.

NATIONAL AIROIL BURNERS
give a soft gaseous flame that does not injure brick work or boiler tubes. Made with flat or round tips.

Write for our Bulletin No. 21

National Airoil Burner Company

Factory: S. W. Cor. 9th and Thompson Sts.
Sales Rooms: 1327 Girard Avenue
PHILADELPHIA, PA.

Oil Burners and Oil Burning Equipment

each with connections for pressure gauge and thermometer.

One steam oil heater having capacity of 40 to 50 G. P. M. from 100 to 300 degrees F. with steam at 160 pounds gauge.

One oil pressure gauge with gauge rock.

Four one and one-fourth-inch steam manifold headers.

Seventeen half-inch flexible, metallic-covered hose connections for steam manifolds.

One steam pressure gauge with syphon and gauge cock with one-fourth-inch connection, range 0 to 200 pounds.

Seventeen half-inch nickel bronze, globe valves.

One half-inch bronze globe valve and two sections of flexible hose, complete, for oil burners used on separately-fired super-heater.

Two steam turbine driven rotary pumps with by-pass mounted complete on base connected to a gear pump, "Weidig" type, with intermediate gears —the whole properly mounted on base and connected to the rest of the equipment.

Two Griscom-Russell fuel oil heaters, each having capacity sufficient to heat 375 barrels of oil per day from 100 degrees F. to 214 degrees F. with sufficient dry and saturated steam at 150 pounds pressure, are also installed at the boiler house of the Parco refinery.

The essential power plant equipment in the power house proper consists of two 500 K.W. Turbo-Alternator units, each being composed of the following:

Terry frame, G. F. multi-stage steam turbine, complete with governor valve, Monel-metal fitted, actuated by oil relay; and separated emergency governor, also with Monel fittings and synchronizing device.

Allis-Chalmers alternator with direct-connected exciter.

Both pieces of equipment are mounted on a substantial cast-iron base plate and connected together by means of a flexible coupling. The generators are 2300 voltage.

Other essential equipment includes:

Three boiler feed units, each unit consisting of a type "E" Terry steam turbine with multi-stage boiler feed pump, bronze fitted, each unit having a capacity of 200 G.P.M. against a total pressure of 200 pounds, the turbine being designed for 160 pounds steam pressure, 100 degrees to 125 degrees superheat and 20 pounds back pressure. The complete unit consists of turbine and pump—the whole being mounted on a substantial cast-iron bedplate and connected together by means of a flexible coupling. With this equipment is also in use a Terry-Foster pump regulator, which is mounted on the turbine governor housing. The pump used with each unit is a Worthington pump having the following characteristics: three-inch, four-stage, 50 horsepower, 52 per cent efficiency, 2100 R.P.M., 65 pounds steam consumption.

The steel valves used for the turbines driving the generator sets and for the turbines driving the boiler feed pumps are designed to operate satisfactorily at 200 pounds pressure, steam temperature of 540 degrees F.

Nine air-filtering units are used in connection with the operation of the two 500 K.W., 3600 R.P.M. Allis-Chalmers generators.

Pressure regulating valves in use in the power house at the Parco refinery include:

One six-inch class "FK" Leslie pressure regulating valve, specially fitted to reduce 165-200 pounds steam to 21 pounds steam, superheated to 125 degrees F.

two-inch, class "E" Leslie pressure regulator, screwed ends.

One three-inch, class "E" Leslie pressure regulator, flanged to withstand a boiler pressure of 165 to 200 pounds with 100 degrees superheat.

Transformer Oils—A Refining Specialty

(Continued from page 48)

another agitator and again brought up to 300° F. Three to four subsequent dumps of clay are given the oil until the desired color specification is obtained. When this has been accomplished the oil is then pumped to a finished oil tank and tested for the above specifications.

There are several methods for determining the percentage sludge formation in a finished transformer oil, among which are the German, French, British and Brown-Boveri tests. These methods will not be discussed in this article since each is a modification of the other. Of the four methods, the Brown-Boveri sludge test seems to give the best and most reliable results. They state that transformer oils should be tested as nearly parallel with service work as possible. This method is particularly good, in that it not only tests for sludge, but for the tendency to form acids, and effect of the insulation upon the transformer under a load. It is of interest to note that these tests are made on samples of oils both in the presence of and absence of air. More striking than the above is their method of testing oils at increasing intervals of time (100, 200, 300 hours), determining thereby any cumulative decomposition of same. Their system of testing is so planned as to include the changes indicated by the German, French and British sludge tests and include many other features which have essential bearing upon that problem.

Relative to the manufacture of transformer oils from paraffine base oil it will me unnecessary to repeat the method of treatment, as it is precisely that followed in the case of naphthenic base oils, with the exception that varying amounts of 98 per cent sulphuric acid are used, depending on the viscosity of the stock and the final N. P. A. color desired.

There are just one or two points I wish to mention before closing. The already extensive and growing application of electricity and electrical appliances to industry has demanded thorough research on the part of the petroleum chemist. So important has it become that the subject of transformer oil manufacture, its tests and specifications, is at present considered to be the most stringent and most difficult. A review of the specifications as required by European countries, as well as by ourselves, will assure one of these facts. The life of the transformer is directly dependent upon the quality of oil used in it.

Unanswered Questions

A great many points have been successfully decided regarding transformer oils, their manufacture, uses and qualifications, yet there are many questions which must still be answered, among which are the following:

1. What test can be devised to determine the tendency to form sludge under abnormal conditions of very high temperatures?

2. What is the temperature to which various oils may be repeatedly heated without appreciably altering their physical properties?

3. Under abnormal conditions of very high temperatures in the laboratory, what, for any given temperature, is the time required for formation of sludge?

4. Under normal working conditions what period of time elapses before the tendency to sludge formation is manifested in high tension transformers?

5. How are the electrical properties of the oils and the formation of sludge affected by the circulation of air over their surfaces?

6. What change in gravity, flash point, viscosity, relative thermal transference, dielectric strength and specific resistance accompany the formation of sludge?

7. What is the amount of moisture which can be absorbed from the atmosphere by a dry oil at various temperatures, and how should such increment of moisture be determined?

8. In determining dielectric strength and insulation resistance, what apparatus should be employed, how are different methods comparable, and what standard conditions, such as shape of electrodes, intervening distance, depth of immersion, movement, if any of oil, etc., should be adopted?

9. Is it possible to express the relative thermal transference of any oil at increasing temperatures as a function of its specific gravity and viscosity at such temperatures?

10. Whether or not the gases which are liberated by the arc have any detrimental effect upon the oil, what their chemical composition, are, and whether different gases are formed from different grades of transformer oils?

These are only a few of the fundamental questions asked by the electrical engineers and they have given the petroleum chemist a great deal of material on which to work.

It cannot be emphasized too strongly the importance of quality of the finished product in the manufacture of transformer oils. The manufacture of a good transformer oil is a difficult problem. However, our refiners are coming closer and closer to the product they would like to manufacture, thanks to the co-operation of the petroleum chemist.

Such Preference Must Be Deserved!

It's Lustre Holds Indefinitely

Lincoln said "You can fool some of the people some of the time"—you know the rest! His statement still holds good today.

Certainly, unless the 90%—and more—of all the leading gasoline pump makers of America who use "WATER-CLEAR" trade marked glass cylinders exclusively had found them to be better cylinders than they could buy elsewhere, they would not continue their use, year after year.

Some authorities believe that certain rays of sunlight cause cracked gasoline to turn yellow, and that if these particular rays of light can be prevented from entering the gasoline through the glass, this trouble will be eliminated. To meet this requirement we can supply our

"SUPER" Water Clear

Cylinders, and they are available to ANY and ALL pump makers.

Of course, we cannot control refining processes. Our cylinders do display gasoline, however, to good advantage, imparting a glistening water-white appearance to a slightly discolored gasoline, and bring out all of the sparkling brilliance of water-white gasoline, or the various colored gasolines. Should a "SUPER" Water Clear Cylinder become soiled or dirty from any cause, it can be easily cleaned and restored to its original sparkling brightness, because the chemical composition of these cylinders prevents pitting or deteriorating with age. They retain their luster and polished surfaces for years. We will replace any cylinder, free of charge, which deteriorates while used on a pump, for five years from its installation.

"SUPER" Water-Clear cylinders are made in the only plant in America devoted wholly to the making of cylinders for pump manufacturers.

Write us for further information.

WATER CLEAR

The Hyatt Glass Co.

Poteau, Okla.

Mere Water Treatment Beneficial to Some Decolorizing Clays

GENERALLY speaking, the term clay is used in a broad sense to include those natural substances such as diatomaceous earth, kaolinite and other members of the kaolin division such as halloysite, newtonite, cimolite, montmorillonite, prophyllite, and so forth; the various types of fullers earth; clay-like rocks such as bentonite, and other substances of volcanic origin, e. g., altered volcanic ashes, tuffs or volcanic breccies or pyroclasts; clay or gouge minerals such as leverrierite, etc.

Some of these clays (using the term in the sense as defined above) possess some decolorizing value in their raw state. This is especially true of the type known as fullers earth and, particularly, of the grades of fullers earth found in Florida, Georgia and certain parts of Texas and other states. Bentonite and related members of this "family" are sometimes found in a condition in which, on certain oils, they possess a noticeable and, very often, appreciable decolorizing value in their raw state. In most cases, however, a special treatment of the clay (usually involving the use of sulphuric acid) is necessary in order to bring the clay (bentonite) to its maximum value as a decolorizing agent.

During the past 15 years the better known processes for producing a satisfactory decolorizing material from clays of this type have involved the use of a mineral acid (sulphuric and hydrochloric acids are equally efficient, but the former is usually used) for removing or altering the acid-soluble constituents of the clay. In the methods proposed from five to 50 per cent by weight of acid to that of clay is used, and the processes involve either removing the salts of reaction by washing with water, or allowing these salts to remain in the clay and either drying and pulverizing the same, or removing the excess moisture and maintaining the treated material in a mudded condition for intermixture with the oil. These finished products possess varying adsorptive properties and have proved successful in decolorizing, neutralizing and otherwise purifying oils.

However, the relatively large amount of acid required to cause a marked increase in the decolorizing properties of the clay make such poccesses very expensive. If the salts of reaction are removed from the clay by washing, there is a large loss in weight; while if these salts are allowed to remain in the clay, its decolorizing properties are increased but little. In either process there is a large consumption of acid.

Water Aids Some Clays

Several years ago it was found that the decolorizing and deacidifying efficiency of certain clays could be increased by washing the clay with water and removing the excess moisture or, in some cases merely by the addition of water up to 500 per cent by weight of water to that of clay and then maintaining the clay in a mudded condition until applied to the oil to be treated.

The advantage of this process lies in the fact that no acids of any kind are used and the decolorizing value of the particular clays that are readily susceptible to this treatment is increased by a simple and inexpensive process. It is to be noted that the clays thus treated can be washed with water with very little loss in weight as compared to the large losses incurred in the extensive washing of highly acid-treated clays. Although washing increases the efficiency of some clays, the "washing-out" process is not always necessary or advisable and a single quantity of water alone may be added to the clay, after which the clay-pulp thus removed is ready for application to the oil to be treated. The loss of weight in washing the clay with water is small; on the other hand, it is a self-evident fact that no loss whatsoever takes place when the water is added direct to the clay in the proportions desired.

Concerning the reasons for certain clays' being able to decolorize oils, it might be mentioned that it has long been known in the art that the adsorptive powers of clays are dependent primarily upon their internal structure. Upon examination under the ultra-microscope and in polarized light, it has been found that those clays possessing high adsorptive values have a very fine micro-structure. In fact, the particles themselves are honeycombed by innumerable microscopic channels that bring about an enormous increase in the adsorptive surface. In many of the natural occurring clays and clay minerals, these pores are clogged with various impurities consisting mostly of acid and water-soluble salts, such as carbonates, sulphates and chlorides.

Impurities Water-Soluble

In examining and making comparative filtration tests with various samples of bentonite, and clays of similar characteristics, it was found that a large proportion of these impurities are water-soluble and, therefore, are removable by washing. Since the adsorptive capacity of a clay is dependent upon the adsorptive surface exposed, it is evident that the removal of these water-soluble constituents from the microscopic channels enormously increases the adsorptive surface and, therefore, the adsorptive power of the clay.

Furthermore, the majority of those clays possessing decolorizing value are composed largely of crystalline silicates. The results of work done along this line by most investigators would seem to indicate that colloidal silica and silicates have a more porous structure than the same substance in crystalline form. Washing or soaking the clay in hot or cold water, preferably luke warm water, for various periods of time seems to tend to convert the crystalline silicates present in certain particular clays to the colloidal or amorphous form, thereby greatly increasing the adsorptive power of the clay so treated.

Finely pulverized filtering materials upon exposure to the atmosphere rapidly adsorb gases and other impurities from the air. The adsorbed fumes and gases not only fill the pores of the clay but also have a detrimental oxidizing effect upon their internal structure. Washing or soaking the clay in hot or cold water not only clears these pores of gaseous impurities, but keeps them open until such time as the clay is applied to the oil.

Aside from the above, it might also be mentioned that, provided there is eliminated any oxidizing influences of the air, and other factors being the same, heating oil and clay in the presence of superheated steam to a temperature very close to or at the point at which the oil begins to distill will also give a greater decolorizing value for the clay than if the two are heated merely to, say 250 degrees or 300 degrees F.

Comparative Results

Table 1 shows the results of efficiency tests made with various samples of fullers earths and bentonites, both dry and, after water treatment applied to the oil as a clay-plup, when heated with the oil to 300 degrees and 500 degrees F.—in both cases in the presence of superheated steam.

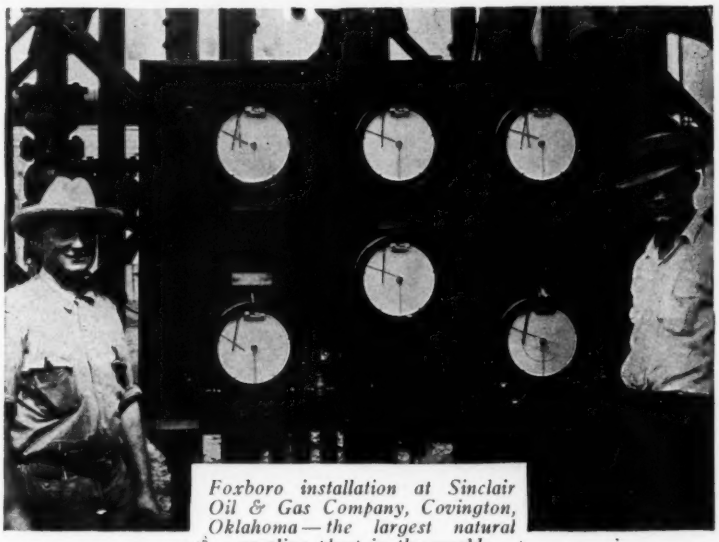
TABLE I

Results of Filtration Tests Showing Effect of Temperature and Method of Application upon Efficiency of Various Clays.

	Maximum Treating Temperature Degrees F.	Efficiency 100 mesh "Standard" Fullers Earth at 300° F. as 1.0	Increase in Efficiency by taking to 500°F. Per Cent.
Fullers Earth 100 mesh..	300	1.00	...
Fuller Earth 100 mesh.. Washed Pulp	500	1.09	9
Fuller Earth 100 mesh.. Washed Pulp	500	1.06	6
Fullers Earth 100 mesh..	500	1.21	21
Bentonite—			
No. 1 Raw Dry	300	0.27	...
No. 1 Raw Pulp	500	0.65	141
No. 2 Raw Dry	300	0.19	...
No. 2 Raw Pulp	500	1.06	458
No. 3 Raw Dry	300	0.27	...
No. 3 Raw Pulp	500	0.82	204
Fullers Earth—			
No. 1—100 mesh	300	0.92	...
No. 1—100 mesh	500	1.15	25
No. 2—200 mesh	300	1.25	...
No. 2—200 mesh	500	1.53	22
No. 3—100 mesh	300	0.92	...
No. 3—100 mesh	500	1.15	25
No. 4—400 mesh	300	0.92	...
No. 4—100 mesh	500	1.15	25

Note—Where the material is not mentioned as being in pulp form the clay was added to the oil in the dry state and heated with fire and steam to a maximum temperature of 500 degrees F.

Attention is called in this table to the



Foxboro installation at Sinclair Oil & Gas Company, Covington, Oklahoma — the largest natural gasoline plant in the world.

By all means—Foxboro Instruments for Still Operation

The value of Automatic Control of still temperatures has been demonstrated so conclusively that the problem now is largely a matter of what instrument.

If you follow the practice of the largest refiners in the country you also will use Foxboro Automatic Temperature Recorder-Controllers.

They are air-operated, can be set directly to the control point, and are positive and simple in action. Just set the control arm and the temperature is automatically held at the exact degree without juggling or manipulation.

Foxboro Automatic Temperature Recorder-Controllers are guaranteed permanent in calibration and are accurate to within less than 1 per cent of total scale range. The Foxboro national reputation for accuracy and dependability should be taken into consideration when deciding the important question of still control. Foxboro engineers are at your service.

Also investigate the Foxboro Automatic Flow Controller which regulates the flow of oil to pipe stills. This instrument balances the whole operation. One oil company estimates a saving of $10,000 *a year from the use of one instrument alone.*

The Foxboro Co., Inc.

Neponset Avenue, Foxboro, Mass., U. S. A.
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FOXBORO
REG. U.S. PAT. OFF.
THE COMPASS OF INDUSTRY

Instruments for Indicating, Recording and Controlling Temperature, Pressure, Humidity and Flow

fact that Bentonite No. 1, after a water wash and applied to the oil in a pulp form, and the whole heated with fire in the presence of superheated steam to a temperature of 500 degrees F. was 141 per cent more efficient than the same clay applied to the oil in a dry state and the whole heated to a temperature of 300 degrees F. Bentonite No. 2, in pulp form, mixed with the oil in the manner mentioned above, was 458 per cent more efficient than the same clay applied to the oil in a dry state and heated to 300 dgrees F. On Bentonite No. 3 there was 204 per cent increase in efficiency by mixing the oil and clay to a temperature of 500 degrees F. instead of 300 degrees F. On several different samples of fullers earth a variation in temperature alone caused an increase in efficiency of from 21 to 25 per cent in favor of the higher temperature.

Water Treating Process

The process by which the water treatment can be carried out is essentially as follows:

The clay or other substance is pulverized and if not sufficiently dry to pulverize readily is previously dried, or partially so. In the case of those clays which disintegrate in water, drying and pulverizing may be omitted. The clay is then mixed with an excess of hot or cold water and, after mixing, the excess water is removed, leaving from 30 per cent to 500 per cent by weight of water to clay in the finished product. This mixing with water, and subsequent removal of the excess water, is repeated as many times as is necessary for the removal of impurities.

As an alternative process to the one above described the washing process may be eliminated and instead from 30 per cent to 500 per cent by weight of hot or cold water may be added to the clay. This mixture may be used immediately in treating oils, or it may be allowed to stand either hot or cold for such a period of time as will bring the product to its maximum efficiency.

Not Applicable to All Clays

The plastic mixture is then added to the oil to be treated and heat applied to the oil and clay mixture to drive off the water and bring about the decolorizing, deacidifying and purifying action of the clay. The treatment of the oil with the clay should be done at a temperature that would insure the driving off of the water from the clay, which would be in excess of the boiling point of water, and maintained at, or above, such a temperature until the reaction is complete.

Not all clays adapt themselves to this simple treatment and with some clays when applied to certain oils in the form of a clay pulp, the efficiency of the clay is lessened instead of increased. This is true more often when the clay pulp is applied to neutral oils. On acid oils, an increase in efficiency is generally to be noted, although here, too, this is dependent upon the nature of the clay that has been given a water treatment.

This principle and process of treating clays with water and then applying such treated clays to oils in order to purify same is "covered" by a patent (No. 1,533,060) issued to I. A. Clark on April 7, 1925, and assigned to Producers and Refiners Corporation, later being transferred by said corporation to H. L. Kauffman, petroleum consultant, of Denver, Colorado, although Producers and Refiners Corporation retained "shop rights." The patent itself relates to certain new improvements in methods of preparing clay for bleaching petroleum, animal and vegetable oils or, perhaps, more particularly to improvements in methods of treating oils with prepared clays. The object of the method of treatment is to improve and increase the decolorizaing and deacidifying properties of clay or similar substances when admixed with light or heavy mineral oils, animal oils, vegetable oils, waxes or fats, etc., without the use of acids or other expensive chemicals. *It is also believed that mixing fine clays with water to form a pulp will further simplify refinery methods of handling clays of fine mesh in the so-called "contact filtration" processes.*

The claims allowed Clark upon his application for patent are quoted below:

1. A process of treating light and heavy mineral oils, animal and vegetable oils, waxes and fats and similar substances, which consists in mixing a filtering material with the amount of water that will form a mudded mass, without the use of acid of any kind, and intermixing the said mass with the oil to be treated.

2. The herein described step in the treatment of petroleum oils to decolorize and purify the same, which consists of washing clay with water and reducing it to a mudded mass without subjecting it to acid of any kind, mixing the oil to be treated with said mudded mass and then heating the mixture to a point above the boiling point of water to drive off said water.

3. The herein described treatment of petroleum oils which consists of washing clay with an excess of water and reducing it to a mudded mass without the use of acid of any kind, removing the excess water to leave a mudded mass and mixing the oils to be treated with the mudded mass.

MARLAND LAWN MOWER

Novel Lawn Mower Used on Marland Tank Farm

Ponca City, Okla.—It may happen later, but so far the roaming lawn mower of the Marland refinery tank farm, namely a herd of goats, has not attempted to eat storage tanks, ladders or vent pipes.

You know the old bromide to the effect that the goat will thrive on tin cans. Storage equipment can be classed as tin.

But the goats are there to keep the weeds and grass down. They have been on the job only a few months and so far have done a better and more economical job than the mowing machine.

Aside from this service, the goats have the possibility of regular wool crops. Shearing will come later and the Marland Refining Company will then be in the market with wool.

Most of the goats are of the whiskered variety—meaning that they are of the male specie—and therefore require less attention than a herd of nannies. However, there are a few females, and several baby goats arrived recently at the Marland tank farm. This fact provides another problem, in that dogs are frequent trespassers, despite the high iron fence.

Because of the frequency with which baby goats are wounded by dogs, if they are not actually killed, it has become necessary to establish a goat hospital for the treatment of the young ones.

The Marland Refining Company is believed to be the first firm in the world to operate a goat hospital in connection with its business of manufacturing high pressure gasoline and super motor oils, and perhaps the first to purchase a large herd of goats for the primary purpose of serving as "mowing machines."

TOMORROW

Huge, man-made birds hurtle through the night — slashing the stillness with their great droning motors. Passengers ride comfortably in Leviathans of the air —swift, secure. Sacred every task that contributes to their safe, sure service to the world — important the fuel—the life blood of the aeroplane.

NATURALINE
A SUPER AVIATION MOTOR FUEL

MAKING THE AIR SAFE FOR HUMANITY

Ever toward the morrow Chestnut and Smith Corporation has been striving for perfection in motor fuel. Through this pioneer urge and painstaking effort of research and laboratory experiment "NATURALINE" has been produced to help make the air safe for humanity. Through practical test and use, it has proven from every standpoint to be the ideal aviation fuel.

CHESTNUT & SMITH
CORPORATION
Tulsa, Oklahoma

Mention Where You Saw the Advertisement

Blending Weak and Fluming Acids May Be Economical

By H. L. KAUFFMAN

WHEN the margin of profit is small, it is necessary for the successful refiner to be "on his "toes" at all times as to how he either may decrease his operating costs or manufacture products of such exceptional quality as to receive premium prices. Hence the average refiner is interested in any means that will net a greater profit for him.

Having in mind the fact that some refiners are located away from a supply of sulphuric acid so that freight tariffs constitute an appreciable proportion of the cost of the acid, a study was made of conditions under which it would be more economical for the refiner to blend weak with fuming sulphuric acid than to concentrate the weak acid back to 65 to 66 degrees Baume acid again.

The writer wishes to emphasize, before entering upon this discussion, that the economy of the operation is dependent entirely upon the cost of 66 degree acid at the refinery and the refinery cost of concentrating weak acid.

First, however, a few comments concerning the properties of acids of various strengths would be worth while.

In ordinary refinery practice either 66 degree Baume acid, containing 93.19 per cent by weight of sulphuric acid, or 98 per cent acid are generally used in chemically treating the hydrocarbon oils. In tne manufacture of medicinal oils, and occasionally, in making special lubricating oils from certain California crudes, fuming sulphuric acid is used, the grade of this acid bought by refiners usually having a strength of 104.5 per cent and containing 20 per cent of free sulphur trioxide (SO_3).

Fuming sulphuric acid, commonly called oleum, is the name given to an acid having a strength above 100 per cent, at which point it begins to fume, due to the fact that above 100 per cent the acid is charged with free sulphur trioxide (SO_3). Acid having a strength of 106.8 per cent contains 30 per cent of free sulphur trioxide. Incidentally, the difference in weight between 106.8 and 98 per cent acid amounts to 102 pounds to the ton, since fuming acid weighs 121 pounds per cubic foot while 98 per cent acid weighs only 115 pounds per cubic foot.

Some refiners have given consideration to the blending of 106.8 per cent acid with weak, recovered acid. In studying such proposals it must be borne in mind that 106.8 per cent acid will solidify at 62 degrees Fahrenheit, and hence special equipment is required for storing and mixing acid of such strength. Acid of 104.5 per cent strength will freeze at plus 12 degrees Fahrenheit, so that only ordinary precautions are necessary for keeping this particular acid fluid.

Computations on Blending

Being of the opinion that solutions of practical problems make the best illustrations, the writer shows below the results of calculations made to determine the amounts of fuming acid (104.5 and 106.8 per cent), and weak acid (40.5 degrees Baume and 60.7 degrees Baume), required to make 93.19 (66 degrees Baume), and 98 per cent acid.

(1) 40.5 degrees Baume gravity acid, by actual determination, contained 41.38 per cent H_2SO_4.

By table, pure acid of 40.5 degrees Baume should contain 48.79 degrees H_2SO_4.

(a) How many pounds of a 104.5% acid (20% free SO^3) must be added to 1.000 pounds of a 41.38% acid (40.5 degree Be.) to make the whole to a 93.18% acid? (b) To a 98% acid?

$$X = 1{,}000\ \frac{(93.19-41.38)}{(104.5-93.19)}$$

X = 4,580 pounds of fuming acid (20%).

By weight

17.92% 40.5 degrees Beaume acid containing 41.38% H_2SO_4.

82.08% fuming acid (20% free SO_3) —104.5% H_2SO_4.

100.00% 66 degree Beaume acid—93.19% H_2SO_4.

(b) $X = 1{,}000\ \frac{(98.00-41.38)}{(104.5-98\ 00)}$

X = 8,708 lbs of fuming acid (20%).

By Weight

10.30% 40.5 degree Beaume acid containing 41.38% H_2SO_4.

89.70% fuming acid (20% free SO_3) —104.5% H_2SO_4.

100.00% "98" acid.

(2) (a) How many pounds of an 106.75% acid (30% free SO_3) must be added to 1,000 pounds of a 41.38% acid (40.5 degree Be.) to make the whole to a 93.19% acid? (b) To a 98% acid?

(a) $X = 1{,}000\ \frac{(93.19-41.38)}{(105.75-93.19)}$

X = 3,821 pounds of fuming acid (30%).

By Weight.

20.74% 40.5 degrees Beaume acid containing 41.38= H_2SO_4.

79.26% fuming acid (30% free SO_3) —105.75= H_2SO_4.

100.00% 66 degree Beaume acid—93.19% H_2SO_4.

(b) $X = 1{,}000\ \frac{(98.00-41.38)}{(105.75-98.00)}$

X = 6,471 pounds of fuming acid (30%).

By Weight.

13.39% 40.5 degree Beaume acid containing 41.38 H_2SO_4.

85.61% fuming acid (30% free SO_3) —105.75% H_2SO_4.

100.00% "98" acid.

(3) 60.7 degree Be. gravity acid, by actual determination, contained 77.50% H_2SO_4.

By table—pure acid of 60.7 degree Be. gravity should contain 78.92% H_2SO_4.

(a) How many pounds of a 104.5% acid (20% free SO_3) must be added to 1,000 pounds of a 77.50% H_2SO_4 (60.7 degree Be. gravity) to make the whole to a 93.19% acid? (b) To a 98% acid?

(a) $X = 1{,}000\ \frac{(93.19-77.50)}{(104.50-93.19)}$

X = 1,387 pounds of fuming acid (20%).

By Weight.

41.89% 60.7 degree Beaume acid containing 77.50% H_2SO_4.

58.11% fuming acid (20% free SO_3) —104.50% H_2SO_4.

100.00% 66 degree Beaume acid 93.19% H_2SO_4.

(b) $X = 1{,}000\ \frac{(98.00-77.50)}{(104.50-98.00)}$

X = 3,154 pounds of fuming acid (20%).

By Weight.

24.07% 60.7 degree Beaume acid containing 77.50% H_2SO_4.

75.93% fuming acid (20% free SO_3) —104.50% H_2SO_4.

100.00% "98" acid.

(4) (a) How many pounds of a 106.75% acid (30% free SO_3) must be added to 1,000 pounds of a 77.50% acid (60.7 degree Be. gravity) to make the whole to a 93.19% acid? (b) To a 98 % acid?

(a) $X = 1{,}000\ \frac{(93.19-77.50)}{(106.75-93.19)}$

X = 1,157 pounds fuming acid (30%)

By Weight.

46.36% 60.7 degree Be. acid containing 77.50% H_2SO_4.

53.64% fuming acid—(30% free SO_3)—105.75% H_2SO_4.

100.00% 66° Be. acid—93.19% H_2SO_4.

(b) $X = 1{,}000\ \frac{(98.00-77.50)}{(105.75-98.00)}$

X = 2,343 pounds of fuming acid (30%).

By Weight.

29.91% 60.7 degree Beaume acid containing 77.50% H_2SO_4.

70.09% fuming acid (30% freeSO^3) 105.75% H_2SO_4.

100.00% "98" acid.

Making calculations in a manner sim-

ilar to that indicated above, merely substituting particular strengths of acid for the problem in hand, the interested person can ascertain—knowing the refinery costs of new and reclaimed acid—whether or not it would be economical at that particular refinery to purchase fuming acid for blending with weak acid to make 66 degree Be. acid.

Blending the Acids

The blending of strong acid with weaker acid requires a small mixing plant. This plant should consist of a steel tank, together with pump and cooling pipes through which to circulate the mixing acid and over which cooling water should be sprayed in order to extract the heat from same.

Another method of mixing, involving merely the use of a couple of steel tanks as blow cases, is essentially as follows:

The requisite amount of strong acid is put into one blow case, after which the required amount of weak acid necessary for making the mixture is placed on top of the fuming acid in the same blow case. Then, the contents of that blow case are discharged to the other blow case, now back again from the second to the first, and so forth, until the acids are thoroughly mixed. It might be mentioned at this point that acids of different strength are very difficult to mix thoroughly.

This latter mentioned method of mixing is applicable only when it is desired to blend relatively small quantities of weak and strong acid; for, in this method, an excessive heating (caused by the absorption of the water in the weak acid by the stronger acid) takes place and hence mixing must be done very slowly.

The data and remarks appearing in succeeding paragraphs are based on a study of whether or not it would be economical to blend weak (61 degree Be.) acid with fuming (20 per cent free SO_3 acid to a strength of 66 degree Be. (93.19 per cent H_2SO_4) instead of further evaporating the weak acid to 66 degree Be. acid in the acid recovery plant.

Data are given primarily for illustrating the various points to be considered in such a matter and are not necessarily typical, since this is an operating problem that must be analyzed for conditions as they exist at each particular refinery.

Summary of Results

Amount of fuming sulphuric acid (20% SO_3) required and approximate cost of blending acid:

	Per. Lb.
53% acid of 61.7 degree Be. gr. (80.48% H_2SO_4) at	.00386c
47% fuming 20% (oleum) at	.014c
100% blended 66 degree acid (93.19%) H_2SO_4) at	.00862c

Supplying refinery requirements of 66 degree acid.

Comparative cost by blending and by restoring (based on Sept., 192-) production of 66 degree restored acid):

1. Blending to 66 degrees.
   212,000 lb. weak acid (equivalent of 185,000 lb. 66 degree restored in September) at .000386— . .....$ 818.00
   188,000 lb. fuming 20% at .014—. $2,632.00
   400 000 lb. blended 66 degree acid at .00852— $3,450.00
2. Restoring to 66 degree and purchasing new 66 degree.
   185,000 lb. restored 66 degree at .00698— $1,292.00
   215,000 lb. new 66 degree acid at .0115— $2,472.00
   400,000 lb. (restored and new) 66 degree at .00941..$3,764.00
   Saving per month in favor of blending $314.00

Conclusion

Blending 61 degree stock from lead pans with fuming 20 per cent acid would, on a monthly requirement basis of 400,000 lb. 66 degree acid, result in a saving of apporximately $314.00 per month, as compared to cost of restored 66 degree acid for Sept., 192— (which is better than an average month) and purchase of additional new acid to make up a 400,000 lb. monthly requirement.

A material advantage over blending could be realized:

1. By increasing the average monthly output of 66 degree acid to exceed 125,000 lbs. per month (September production, which is considerably more than the average monthly production since Jan. 1, 192—). This would require more efficient stills and a much larger supply of weak 61 degree reclaimed acid than has been available.
2. By reducing the charge for depreciation of still to a minimum, through purchase of stills much more durable and cheaper than those now used.

In other words there must be sufficient 61 degree stock available to produce an average of from 220,000 to 240,000 lbs. 66 degree restored acid per month and stills should show at least 100 per cent increase in operating hours at a reduction in first cost (including installation) of approximately 50 per cent as against stills now used.

While 185,000 lbs. output has been exceeded over individual months (224,000 lbs. being the highest monthly-production ever attained) it has been much below that figure during a considerably greater period.

Records at this refinery also show that stills much cheaper and more durable than the present stills were purchased and operated in 192—, but average production in 192—was only 132, lbs. per month. Consequently, it is believed that it would be difficult to maintain a monthly average output greater than 185,000 lbs. 66 degree restored acid and the possibility of purchasing more durable stills at much less than the present price is also somewhat doubtful in the light of past experience. It can therefore be concluded that it would be more advantagous to blend fuming and weak 61 degree acid rather than as at present to restore to 66 degree strength and purchase new acid to make up the monthly requirement.

Detai's of Calculations.

1. Pounds 66 degree acid reclaimed in Sept., 192—	185,000
2. Pounds 61.7 acid corresponding to 66 degree acid	212,000
3. Pounds fuming acid to blend 61.7 to 66 degree	188,000
4. Pounds 66 degree acid resulting from blend	400,000
5. Pounds 66 degree acid in addition to (1) to be purchased to make 400,000 lbs.	215,000
Cost of 185,000 lbs. restored acid at .007— $1,292.00	
Analysis of Cost (Sept. 192—):	
Fuel . .....$	331.00
Operating labor	490.00
Repairs to still	47.00
Depreciation of still	345.00
(288 still hours at $1.20 per hour)	
Fixed charges	79.00
(By difference)	
	$1,292.00
Cost of 215,000 lbs. new 66 degree acid at .0115 .....$2,472.00	
Total cost of 400,000 lbs. 66 degree acid	3,764.00
Estimated cost of 212,000 lbs. 61 degree acid at .00386	818.00
Analysis of cost (Sept., 192—):	
Fuel $249.00	
Operating labor	490.00
(Same as when the still is operated)	
Fixed charges	79.00
Total $818.00	
Cost of 188,000 lbs. fuming 20 per cent at .014 .....$2,632.00	
Total cost 400.000 lbs. 66 degree acid by blending	3,450.00
Saving per month in tavor of blending	314.00

Notes:

Cost of fuming acid based on market quotation . .....$19.00 Per Ton

Freight from ———to——— 9.00

Total cost $28.00

Fuel required for evaporating in still from 61 to 66 degree is calculated as approximately one-fourth (¼) the amount required to evaporate completely from 35 degree to 66 degree. This is based on equivalent amounts of water evaported.

Labor is figured the same as when the still is not operated. In actual blending practice, however, it should be possible to operate the lead pans to capacity 15 days per month to supply 61 degree acid requirement and transfer the labor to other work the remainder of the time, resulting in 50 per cent reduction in labor cost.

All calculations are based on September, 192— operation of acid plant Average production per month from January, 192— has been 105,000 pounds, but this is not comparable to previous

months and scarcely represents normal operation.

Amount of acid that it is possible to reclaim in one month depends upon the quantity of 61 degree acid available and number of operating still hours. Shutdowns during September were due to:

1. Repairs to Still .....288 hrs.
(Includes cleaning)
2. Shortage of 61 degree acid 144 hrs
3. Total .....432 hrs.

With no shortage of 61 degree acid the output of 66 degree acid, figured at 8 tons per 24 hrs., would have been increased by 48 tons, making a total of 281,000 lbs. restored 66 degree acid. It is doubtful if this figure could ever be reached. The largest amount ever reclaimed in one month at ————, according to plant records, was 244,- lbs. This is probably the maximum production. To maintain an average such as this, assuming sufficient weak acid were available, a more durable still would be required and better facilities for cleaning.

The life of the stills now being used has averaged 550 hrs. Cost, including the installation of still, is approximately $660.00 or $1.20 per operating hour. This has been figured as depreciation and on the basis of September operation (288 hrs.) amounts of $345.00.

Effect on Cost by Increasing Life of Still and Decreasing First Cost.

In 192— plant records show that the stills were purchased from ..... at a considerably lower price than the present ones. These stills lasted 1,000 to 1,200 operating hours.

Depreciation on these stills could be estimated as follows:

Purchase price	$130.00
Freight (approx.)	25.00
Installation	100.00
Total first cost	$255.00

Life of still—1,000 hrs. average.

Depreciation—25.5c per hr. operated.

Estimated cost of 185,000 lbs. 66 degree acid.

Fuel	$ 331.00
Operating labor	490.00
Repairs	47.00
Depreciation (288 hrs. at 0.255)	73.00
Fixed charges	79.00
185,000 lbs. 66 degree restored acid	$1,020.00
215,000 lbs. 66 degree new acid	2,472.00
400,000 lbs. 66 degree acid	3,492.00

This is still slightly more expensive than blending.

T. S. Cooke has left Casper for Chicago where he will assume his duties as general manager for Pan American Petroleum Corporation, after having spent the last several years in Wyoming as general manager for the Standard Oil Company of Indiana in the Rocky Mountain region.

TESTING GASOLINE FOR ANTI-KNOCK QUALITIES IN MARLAND LABORATORY

Marland Installs Anti-Knock Machine

Ponca City, Okla.—The Marland Refining Company has added equipment for testing gasoline for its anti-knock qualities in the laboratory here. The equipment is that known as the Midgley, having been developed by Thomas C. Midgley, Jr., of the General Motors group of engineers.

The equipment and its operation were described as follows in a recent issue of The Marland Service Man:

"The equipment, consisting of Modified Delco Farm Lighting Equipment, is used expressly for testing the relative anti-klock value of different fuels.

"The single cylinder, water cooled engine is equipped with a specially designed head for the purpose of accommodating the Midgley Bouncing Pin Apparatus, which is used for measuring the intensity of the knock and which consists of a cylinder, in which operates a carefully fitted piston, resistance to movement of the piston against pressure being accomplished by a carefully milled spiral spring, the spring being so designed as to give a deflection of the piston of approximately 0.005 of an inch under 200 pounds pressure. On top of the piston rides a steel rod, or the bouncing pin which, due to abnormal or violent movement of the piston, bounces off its seat, causing an electrical contact to be made on the upper end of the apparatus. The electrical contact is wired to a graduated electrolytic cell in which gas is formed, depending upon the amount of contact created by the bouncing pin. In the operation of this equipment, the engine is operated at a uniform speed, namely, 1000 R.P.M., the water outlet temperature controlled to 180 degrees F., the bouncing pin is adjusted so as to form between 0.5 and 0.75 c.c. of gas per minute when using a standardized reference fuel.

"All tests are made on the basis of comparison between the reference fuel and the fuel to be tested, to which has been added a definite amount of some-anti-knock compound. In this manner it is possible to find out the anti-knock value of any particular sample of fuel, by determining the amount of anti-knock compound it is necessary to add to the fuel under test in order to match the reference fuel."

Natural Gasoline Body Changes Name

Tulsa, Okla.—The following excerpt from a bulletin of October 27 from the office of A. V. Bourque, the secretary, reads:

"Our association is now known as the Natural Gasoline Association of America. Some months ago when the Natural Gas Association of America merged with the American gas Association and discontinued its charter, a vote was taken as to whether or not the association should change its name in lieu of the unwieldly one by which we have been known since our organization. The vote was unanimously for the change.

"When our organization was formed, the name 'Natural Gasoline Association' was suggested, but some of our members believed it was too nearly like that of the Natural Gas Association and might cause confusion, hence the reason we adopted our old name. Following the merging of the Natural Gas Association with the American Gas Association the matter of the change in name was taken up with officials of the natural gas department (old Natural Gas Association) of the American Gas Association to see if there could possibly be any conflict in the names. I am now happy to say that word has been received from that association to the effect that there is no objection on their part, so in the future we will be known as the Natural Gasoline Association of America.

"While the name seems almost as unwieldly as the old, the fact is that we have been called the Natural Gasoline Association for a long time and will continue to be known by that designation in the future, the full title only being carried in our official correspondence. I am sure that you will agree with me that the new name, 'Natural Gasoline Association' is for the best and that we will continue to grow and prosper under the new title."

Program Arranged for Texas Division

Fort Worth.—The annual meeting of the Texas Division of the Mid-Continent Oil & Gas Association will be held in Fort Worth Friday, November 11. Beginning at 9:30 a. m., there will be a business session in the forenoon in the Longhorn room of the Texas Hotel. At this meeting directors for the ensuing year will be elected, the annual report will be made and other matters will be discussed. In the afternoon those in attendance will be entertained by the Wildcats at the River Crest Country Club with a golf tournament and other features. Three trophies are offered in the golf tournament. All oil men and those having affiliated interests will be welcome.

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Analysis of Crude Oils From the Seminole District, Oklahoma

By A. J. KRAEMER[1]

THE Bureau of Mines for a number of years has been carrying on an investigation of properties of crude petroleum from producing fields in the United States and the Western Hemisphere, and has published a series of reports on these fields, including oil fields of Oklahoma[2].

Acknowledgments

Thanks are due to R. R. Brandenthaler and Peter Grandone, of the Petroleum Experiment Station of the Bureau of Mines, at Bartlesville, Oklahoma, who reviewed the manuscript and contributed valuable suggestions. The samples were analyzed under the direction of E. C. Lane at the Bartlesville station of the Bureau of Mines.

Production Data

The Seminole District is situated in the center of Seminole County, in east Central Oklahoma, and extends over a region which has for a long time been regarded as favorable by petroleum geologists. The discovery well was the Indian Territory Illuminating Oil Company's well No. 1 Dyer, section 24-9-6, in the Hunton lime at a depth of 3900 feet. This well was the incentive for the intensive drilling campaign which made the district one of the most productive in the history of the petroleum industry in the United States. In July, 1926, the Independent Oil and Gas Company and R. F. Garland drilled a well southwest of the Indian Territory Illuminating Oil Company well and found production in the Wilcox sand in section 26-9-6, at 4000-4100 feet. This well attained a peak production of 8000 barrels. Within 60 days from the bringing in of the Independent-Garland well more than 100 wells were being drilled in the adjacent territory. The production of the Seminole District increased steadily and reached a peak of 525,610 barrels on July 30, 1927, which is the highest daily production for the district to date. This is the largest production of light oil from any single area in the history of the petroleum industry in the United States.

In December, 1926, the completion of unusually large wells caused a congestion of the available pipe line facilities, which initiated price cuts, storage programs, and attempts to reach an agreement to curtail production. Although these factors did not actually decrease the rate of production of the field, they undoubtedly contributed to restrain the yield below what it would have been if crude oil prices had remained where they stood in December, 1926.

The Seminole District at present consists of four pools: (1) Seminole Pool, which is in township 9-6; (2) Bowlegs, which is in township 8-6; (3) Earlsboro, in township 9-5, and (4) Searight, which is in township 10-6. The following table showing the production of the Seminole District for the 24 hours ending 7 a. m., June 25, 1927, is taken from data in the "Oil and Gas Journal," June 30, 1927:

	Wells	Production Bbls.
Seminole	306	104,100
Bowlegs	122	172,928
Earlsboro	79	92,311
Searight	43	36,093
Total	550	405,432

Discussion of Results

For a discussion of the methods used by the Bureau of Mines in analyzing crude oil, see Bulletin 207.[3] For a discussion of the interpretation of crude oil analysis, see Serial No. 2806.[4] Table 1 summarizes the results of these analyses by presenting some of the figures indicating physical and chemical properties of the crudes. Table 2 presents figures for the gravities of the fractions distilling at atmospheric pressure between 250 degrees and 275 degrees Centigrade, and also the cloud points of the fractions distilling between 275 and 300 degrees Centigrade at 40 mm. absolute pressure. These figures indicate of the "base" of a crude oil.[4]

Gravities are reported in A. P. I. degrees. This is the scale formerly known in the American Petroleum industry as "Baume," based on the modulus 141.5 as distinguished from the Baume scale based on the modulus 140.0.[5]

Although there are a number of producing sands in the Seminole District, it does not seem possible to ascribe definite and distinctive characteristics to the production from any of the sands. The Wilcox is the most productive sand in all of the pools in the district. On the basis of the samples that the Bureua of Mines has analyzed, (not all of which are included in the report), the gravity of crude oil from the Wilcox sand in this district ranges from 37.6 degrees to 43.2 degrees A. P. I., with average about 40 degrees A. P. I. The sulphur content ranges from 0.26 per cent to 0.43 per cent with the average about 0.33 per cent. The "gasoline and naphtha" content ranges from 34.1 per cent to 41.3 per cent, with the average about 38.4 per cent. The production from the Hunton lime ranges in gravity between 37.8 degrees and 40.4 degrees A. P. I., with the average about 38.8 degrees A. P. I. The sulphur content ranges from 0.22 per cent to 0.30 per cent, with the average about 0.26 per cent. The "gasoline and naphtha" content of the crude from the Hunton lime ranges from 34.7 per cent to 37.3 per cent, with the average about 36 per cent.

[1]Associate petroleum chemist, Washington, D. C., Bureau of Mines, Department of Commerce.
[2]Dean, E. W., Bauer, A. D., Cooke, M. B., and Bopp, C. R., Properties of typical crude oils from the producing fields of Oklahoma; Reports of Investigations, Bureau of Mines, Serial 2364, June, 1922.
[3]Bureau of Mines Bulletin 207, "The Analytical Distillation of Petroleum and its Products," by E. W. Dean and others. Obtainable from the Government Printing Office, Washington, D. C., at 15 cents a copy.
[4]Smith, N. A. C. The Interpretation of Crude Oil Analyses, Reports of Investigations, Bureau of Mines, Serial No. 2806, May, 1927.
[5]A concise statement of the reasons for the general adoption of the A. P. I. gravity scale has been prepared by the American Petroleum Institute, 250 Park Ave., New York, N. Y.

SAMPLE NUMBER 27335

Oklahoma — Seminole Field — Seminole County
Indian Territory Illuminating Oil Co. — Well No. 4
Section 23-9N-6E Indian — Wilcox Sand, 4136-4138 ft
Specific gravity, 0.827 — A. P. I. gravity 39.6°
Per cent sulphur, 0.33 — Per cent water, nil
Saybolt Universal vis. at 70°F., 42 sec. — Pour point below 5°F.
Saybolt Universal vis. at 100°F., 39 sec. — Color, green

Distillation, Bureau of Mines Hempel Method

Air Distillation — Barometer 737 mm. — First Drop: 29°C. (84°F.)

Temp'ture °C	Per Cent cut	Sum Per cent	Sp. gr. of cut	°A. P. I. of cut	Viscosity at 100°F.	Cloud Test, °F.	Temperature °F.
Up to 50	3.3	3.3	0.643	88.6			Up to 122
50-75	3.4	6.7	.669	80.0			122-167
75-100	6.5	13.2	.709	68.1			167-212
100-125	7.7	20.9	.736	60.8			212-257
125-150	6.6	27.5	.757	55.4			257-302
150-175	5.8	33.3	.777	50.6			302-347
175-200	5.3	38.6	.794	46.7			347-392
200-225	4.9	43.5	.810	43.2			392-437
225-250	5.2	48.7	.826	39.8			437-482
250-275	5.8	54.5	.840	37.0			482-527

Vacuum distillation at 40 mm.

Temp'ture °C.	Per Cent cut	Sum Per cent	Sp.gr. of cut	°A. P. I. of cut	Viscosity at 100°F.	Cloud Test °F.	Temperature °F.
Up to 200	3.1	3.1	.859	33.2	41	10	Up to 392
200-225	5.3	8.4	.865	32.1	49	25	392-437
225-250	4.6	13.0	.879	29.5	61	45	437-482
250-275	4.1	17.1	.893	27.0	91	65	482-527
275-300	4.9	22.0	.905	24.9	165	80	527-572

Carbon residue of residiuum 7.3%. Carbon residue of crude 1.6%.

Approximate Summary

	Per Cent.	Sp. Gr.	°A. P. I.	Viscosity
Light gasoline	13.2	0.682	76.0	
Total gasoline and naphtha	38.6	.735	61.0	
Kerosene distillate	4.9	.810	43.2	
Gas oil	17.3	.844	36.2	
Nonviscuous lubricating distillate	9.8	.866-0.895	31.9-26.6	50-100
Medium lubricating distillate	5.9	.895-.909	26.6-24.2	100-200
Viscous lubricating distillate	..	.....	.....	Above 200
Residiuum	22.1	0.958	16.2	
Distillation loss	1.4	....	....	

(Continued on page 76)

SAMPLE NUMBER 27339

Oklahoma	Seminole Field	Seminole County
Pure Oil Company	Well No. 1	
Section 26-9N-6E Indian	Wilcox Sand, 4128-4129 ft.	
Specific gravity, 0.826.	A. P. I. gravity, 39.8°.	
Per cent sulphur, 0.38.	Per cent water, nil.	
Saybolt Univeral vis. at 70°F., 41 sec.	Pour point, below 5°F.	
Saybolt Universal vis. at 100°F., 38 sec.	Color, green.	

Distillation, Bureau of Mines Hempel Method

Air Distillation. Barometer 734 mm. First Drop: 27°C. (81°F.)

Temp'ture °C	Per Cent cut	Sum Per cent	Sp. gr. of cut	°A. P. I. of cut	Viscosity at 100°F.	Cloud Test, °F.	Temperature °F.
Up to 50	3.4	3.4)					Up to 122
50- 75	5.1	8.5)	0.664	81.6			122-167
75-100	6.3	14.8	.732	67.2			167-212
100-125	7.3	22.1	.737	60.5			212-257
125-150	7.3	29.4	.759	54.9			257-302
150-175	5.3	34.7	.780	49.9			302-347
175-200	5.4	40.1	.796	46.3			347-392
200-225	5.4	45.5	.814	42.3			392-437
225-250	4.9	50.4	.828	39.4			437-482
250-275	5.5	55.9	.841	36.8			482-527
Vacuum distillation at 40 mm.							
Up to 200	3.1	3.1	.846	35.8	41	10	Up to 392
200-225	4.6	7.7	.851	34.8	47	30	392-437
225-250	4.7	12.4	.867	31.7	60	50	437-482
250-275	3.8	16.2	.883	28.8	89	65	482-527
275-300	4.8	21.0	890	27.5	165	85	527-572

Ca bon residue of residuum, 7.7%. Ca bon residue of crude, 1.7%.

Approximate Summary

	Per Cent.	Sp. Gr.	°A. P. I.	Viscosity
Light gasoline	14.8	0.684	75.4	
Total gasoline and naphtha	40.1	.735	61.0	
Kerosene distillate	5.4	.814	42.3	
Gas oil	17.0	.841	36.8	
Nonviscous lubricating distillate	8.4	.855- .884	34.0-28.6	50-100
Medium lubricating distillate	6.0	.884- .894	28.6-26.8	100-200
Viscous lubricating distillate	..	.....	....	Above 200
Residuum	21.9	.958	16.2	
Distillation loss	1.2	..	..	

SAMPLE NUMBER 27240

Oklahoma	Bowlegs Field	Seminole County
I. T. I. O. Company	B. F. Davis Well No. 1	
Section 13-8-6-Indian	Wilcox Sand, 4,194-4,200 ft.	
Specific gravity, 0.834	A. P. I. gravity, 38.2°	
Per cent sulphur, 0.31	Per cent water, nil	
Saybolt Universal vis. at 70°F., 45 sec.	Pour point below 5°F.	
Saybolt Universal vis. at 100°F., 43 sec.	Color, green	

Distillation, Bureau of Mines Hempel Method

Air Distillation Barometer 746 mm. First Drop: 28°C. (82°F.)

Temp'ture °C	Per Cent cut	Sum Per cent	Sp. gr. of cut	°A. P. I. of cut	Viscosity at 100°F.	Cloud Test, °F.	Temperature °F.
Up to 50	2.3	2.3					Up to 122
50-75	3.2	5.5	0.661	82.6			122-167
75-100	6.7	12.2	.076	68.9			167-212
100-125	7.7	19.9	.734	61.3			212-257
125-150	5.9	25.8	.755	55.9			257-302
150-175	6.0	31.8	.774	51.3			302-347
175-200	5.3	37.1	.792	47.2			347-392
200-225	5.4	42.5	.810	43.2			392-437
225-250	5.4	47.9	.824	40.2			437-482
250-275	5.8	53.7	.838	37.4			482-527
Vacuum distillation at 40 mm.							
Up to 200	2.9	2.9	.859	33.2	41	5	Up to 392
200-225	5.1	8.0	.863	32.5	46	20	392-437
225-250	4.7	12.7	.881	29.1	58	45	437-482
250-275	5.8	53.7	.838	37.4	87	60	482-527
225-250	5.4	47.9	.824	40.2	165	80	437-482

Residuum, 23.9%. Distillation loss, 0.2%.
Carbon residue of residuum, 6.8%. Carbon residue of crude, 1.6%.

Approximate Summary

	Per Cent.	Sp. Gr.	°A. P. I.	Viscosity
Light gasoline	12.2	0.686	74.8	
Total gasoline and naptha	37.1	.736	60.8	
Kerosene distillate	10.8	.817	41.7	
Gas oil	13.0	.852	34.6	
Nonviscous lubricating distillate	8.5	.869- .894	31.3-26.8	50-100
Medium lubricating distillate	6.5	.894- .908	26.8-24.3	100-200
Viscous lubricating distillate	..	...	...	Above 200
Residuum	23.9	.952	17.1	
Distillation loss	0.2	...	...	

SAMPLE NUMBER 27343

Oklahoma	Bowlegs Field	Seminole County
I. T. I. O. Co	L. Walker Well No. 1	
Section 15-8N-6E Indian	Wilcox sand, 4111-4134 ft.	
Specific gravity, 0.821	A. P. I. gravity, 40.9°.	
Per cent sulphur, 0.30	Per cent water, nil.	
Saybolt Universal vis. at 70°F., 40 sec.	Pour point, below 5°F.	
Saybolt Universal vis. at 100°F., 38 sec.	Color, green.	

Distillation, Bureau of Mines Hempel Method

Air Distillation. Barometer 740 mm. First Drop: 29°C. (84°F.)

Temp'ture °C	Per Cent cut	Sum Per cent	Sp. gr. of cut	°A. P. I. of cut	Viscosity at 100°F.	Cloud Test °F.	Temperature °F.
Up to 50	3.0	3.0)					Up to 122
50- 75	4.3	7.3)	0.653	85.2			122-167
75-100	5.8	13.1	.698	71.2			167-212
100-125	8.4	21.5	.727	63.1			212-257
125-150	6.5	28.0	.752	56.7			257-302
150-175	5.7	33.7	.772	51.8			302-347
175-200	5.4	39.1	.790	47.6			347-392
200-225	4.5	43.6	.809	43.4			392-437
225-250	5.0	48.6	.823	40.4			437-482
250-275	5.4	54.0	.837	37.6			482-527
Vacuum distillation at 40 mm.							
Up to 200	2.8	2.8	.861	32.8	40	10	Up to 392
200-225	4.9	7.7	.863	32.5	47	25	392-437
225-250	4.5	12.2	.868	31.5	60	45	437-482
250-275	3.8	16.0	.896	26.4	93	65	482-527
275-300	4.8	20.8	.906	24.7	175	80	527-572

Carbon residue of residuum, 6.8%. Carbon residue of crude, 1.5%.

Approximate Summary

	Per Cent.	Sp. Gr.	°A. P. I.	Viscosity
Light gasoline	13.1	0.673	78.8	
Total gasoline and naphtha	39.1	.728	62.9	
Kerosene distillate	9.5	.816	41.9	
Gas oil	11.8	.851	34.8	
Nonviscous lubricating distillate	8.1	.864- .897	32.3-26.3	50-100
Medium lubricating distillate	6.3	.897- .911	26.3-23.8	100-200
Viscous lubricating distillate	..	...	...	Above 200
Residuum	21.5	.953	17.0	
Distillation loss	3.7	...	...	

SAMPLE NUMBER 27337

Oklahoma	Earlsboro Field	Seminole County
Prairie Oil and Gas Company	Well No. 1	
Section 24-9n-5e Indian	Wilcox Sand, 4230-4234 ft.	
Specific gravity, 0.810.	A. P. I. gravity, 43.2°.	
Per cent sulphur, 0.31.	Per cent water, nil.	
Sayboldt Universal vis., at 70° F., 38 sec.	Pour point below 5°F.	
Saybolt Universal vis., at 100°F., 37 sec.	Color, green.	

Distillation, Bureau of Mines Hempel Method

Air Distillation. Baromter 735 mm. First Drop: 24°C. (75°F.)

Temp'ture °C	Per Cent cut	Sum Per cent	Sp. gr. of cut	°A. P. I. of cut	Viscosity at 100°F.	Cloud Test, °F.	Temperature °F.
Up to 50	6.0	6.0	0.635	91.3			Up to 122
50- 75	4.2	10.2	.671	79.4			122-167
75-100	6.6	16.8	.709	68.1			167-212
100-125	7.8	24.6	.736	60.8			212-257
125-150	6.2	30.8	.757	55.4			257-302
150-175	6.1	36.9	.778	50.4			302-347
175-200	4.4	41.3	.795	46.5			347-392
200-225	5.2	46.5	.812	42.8			392-437
225-250	4.8	51.3	.827	39.6			437-482
250-275	5.1	56.4	.841	36.8			482-527
Vacuum distillation at 40 mm.							
Up to 200	2.9	2.9	.846	35.8	41	10	Up to 392
200-225	4.5	7.4	.852	34.6	47	30	392-437
225-250	4.5	11.9	.868	31.5	61	50	437-482
250-275	3.6	15.5	.882	28.9	95	70	482-527
275-300	4.1	19.6	.891	27.3	185	80	527-572

Carbon residuum, 6.1%. Carbon residue of crude, 1.2%.

Approximate Summary

	Per cent	Sp. gr.	°A. P. I.	Viscosity
Light gasoline	16.8	0.673	78.8	
Total gasoline and naphtha	41.3	.726	63.4	
Kerosene distillate	5.2	.812	42.8	
Gas oil	16.1	.840	37.0	
Nonviscous lubricating distillate	7.8	.853- .883	34.4-28.8	50-100
Medium lubricating distillate	5.6	.883- .895	28.8-26.6	100-200
Viscous lubricating distillate	..	...	...	Above 200
Residuum	19.0	.955	16.7	
Distillation loss	5.0	...	...	

SAMPLE NUMBER 27236

Oklahoma	Earlsboro Field	Seminole County
Amerada Petroleum Company	F. Anderson well No. 2,	
Section 15-9-5-Indian	Wilcox sand, 4,257-4,283 ft.	
Specific gravity, 0.827	A. P. I. gravity, 39.6°	
Per cent sulphur, 0.30	Per cent water, nil	
Saybolt Universal vis. at 70°F., 47 sec.	Pour point below 5°F.	
Saybolt Universal vis. at 100°F., 46 sec.	Color, green	

Distillation, Bureau of Mines Hempel Method

Air Distillation Barometer 733 mm. First Drop: 27°C. (81°F.)

Temp'ture °C	Per Cent cut	Sum Per cent	Sp. gr. of cut	°A. P. I. of cut	Viscosity at 100°F.	Cloud Test, °F.	Temperature °F.
Up to 50	4.2	4.2	0.643	88.6			Up to 122
50-75	3.6	7.8	.672	79.1			122-167
75-100	4.2	12.0	.708	68.4			167-212
100-125	6.5	18.5	.733	61.5			212-257
125-150	5.5	24.0	.753	56.4			257-302
150-175	5.2	29.2	.772	51.8			302-347
175-200	4.9	34.1	.788	48.1			347-392
200-225	4.9	39.0	.805	44.3			392-437
225-250	5.1	44.1	.820	41.1			437-482
250-275	5.0	49.1	.834	38.2			482-527
Vacuum distillation at 40 mm.							
Up to 200	2.3	2.3	.856	33.8	42	10	Up to 392
200-225	5.1	7.4	.859	33.2	46	20	392-437
225-250	4.9	12.3	876	30.0	58	45	437-482
250-275	4.6	16.9	.885	28.4	89	65	482-527
275-300	4.5	21.4	.900	25.7	165	75	527-572

Residuum 26.6%. Distillation loss 2.9%.
Carbon residue of residuum 5.5%. Carbon residue of crude 1.5%.

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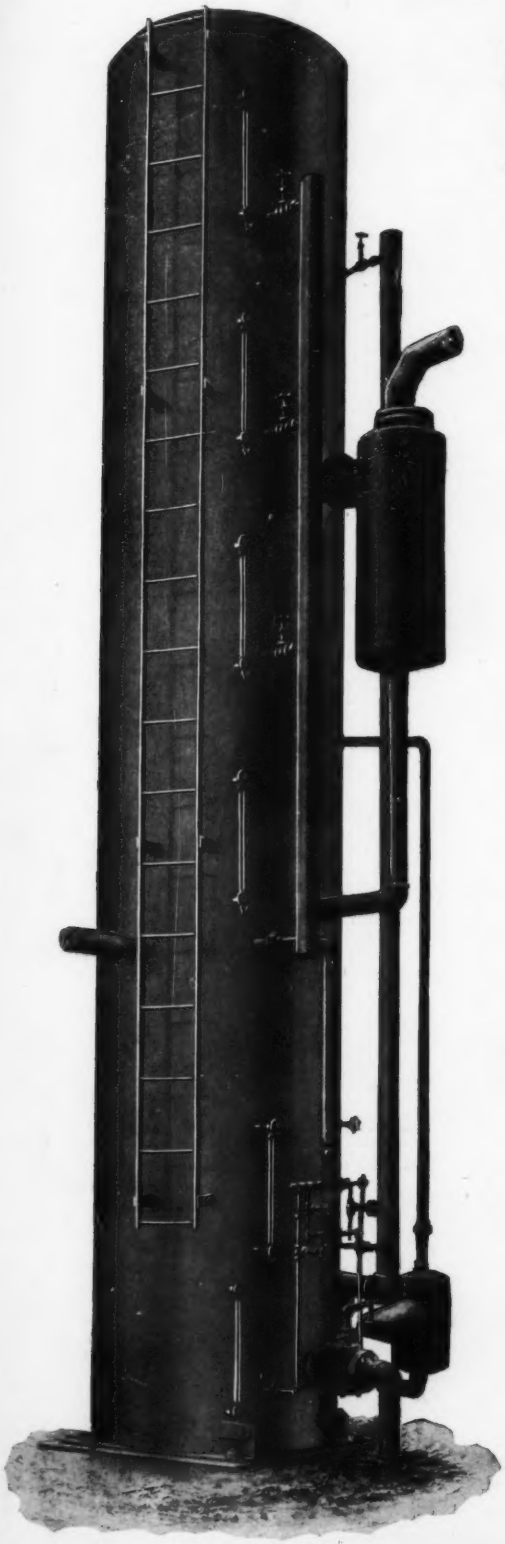
THE PROFIT PROCESS



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Approximate Summary

	Per Cent.	Sp. Gr.	°A. P. I.	Viscosity
Light gasoline	12.0	0.674	78.4	
Total gasoline and naphtha	34.1	.729	62.6	
Kerosene distillate	10.0	.812	42.8	
Gas oil	11.7	.849	35.2	
Nonviscous lubricating distillate	8.6	.865-.887	32.1-28.0	50-100
Medium lubricating distillate	6.1	.887-.907	28.0-24.5	100-200
Viscous lubricating distillate	...	....	....	Above 200
Residuum	26.6	.941	18.0	
Distillation loss	2.9	....	....	

SAMPLE NUMBER 27377

Oklahoma	Searight	Field	Seminole County
Carter Oil Co.		G. W. Frasier Well No. 4	
Section 3-9N-6E Indian		Wilcox sand, 4,502-4,508 ft.	
Specific gravity, 0.837		A. P. I. gravity, 37.6°	
Percent sulphur, 0.35		Per cent water, nil	
Saybolt Universal vis. at 70°F., 47 sec.		Pour point below 5°F.	
Saybolt Universal vis. at 100°F., 45 sec.		Color, green	

Distillation, Bureau of Mines Hempel Method

Air Distillation. Barometer 734 mm. First Drop: 31°C. (88°F.)

Temp'ture °C	Per Cent cut	Sum Per cent	Sp. gr. of cut	°A. P. I. of cut	Viscosity at 100°F.	Cloud Test, °F.	Temperature °F.
Up to 50	1.6	1.6	0.645	87.9			Up to 122
50- 75	2.6	4.2	.668	80.3			122-167
75-100	5.6	9.8	.707	68.6			167-212
100-125	7.5	17.3	.732	61.8			212-257
125-150	6.5	23.8	.755	55.9			257-302
150-175	5.9	29.7	.775	51.1			302-347
175-200	5.0	34.7	.790	47.6			347-392
200-225	5.2	39.9	.807	43.8			392-437
225-250	5.2	45.1	.821	40.9			437-482
250-275	5.9	51.0	8.35	38.0			482-527
275-300	4.4	23.1	.903	25.2	180	80	527-572
Vacuum distillation at 40 mm.							
Up to 200	3.6	3.6	.856	33.8	41	10	Up to 392
200-225	5.6	9.2	.862	32.7	47	25	392-437
225-250	5.2	14.4	.879	29.5	62	50	437-482
250-275	4.3	18.7	.891	27.3	99	65	482-527
275-300	4.4	23.1	.903	25.2	180	80	527-572

Carbon residue of residuum, 6.5%. Carbon residue of crude, 1.6%.

Approximate Summary

	Per Cent.	Sp. Gr.	°A. P. I.	Viscosity
Light gasoline	9.8	0.687	74.5	
Total gasoline and naphtha	34.7	.739	60.0	
Kerosene distillate	10.4	.814	42.3	
Gas oil	13.5	.849	35.2	
Nonviscous lubricating distillate	9.0	.866-.891	31.9-27.3	50-100
Medium lubricating distillate	5.3	.891-.906	27.3-24.7	100-200
Viscous lubricating distillate	1.2	.906-.909	24.7-24.2	Above 200
Residuum	25.3	.943	18.6	
Distillation loss	0.6	....	....	

SAMPLE NUMBER 27336

Oklahoma	Seminole	Field	Seminole Conuty
Indian Territory Illuminating Oil Co.		Stock tank	
Section 24-9N-6E Indian		Hunton lime	
Specific gravity, 0.836		A. P. I. gravity, 37.8°.	
Per cent sulphur, 0.28		Per cent water, nil	
Saybolt Universal vis. at 70°F., 47 sec.		Pour point, below 5°F.	
Saybolt Universal vis. at 100°F., 42 sec.		Color, green.	

Distillation, Bureau of Mines Hempel Method

Air Distillation. Barometer 737 mm. First Drop: 30°C. (86°F.)

Temp'ture °C	Per Cent cut	Sum Per cent	Sp. gr. of cut	°A. P. I. of cut	Viscosity at 100°F.	Cloud Test, °F.	Temperature °F.
Up to 50	2.7	2.7)					Up to 122
50- 75	5.8	5.5)	0.669	80.0			122-167
75-100	4.3	9.8	.712	67.2			167-212
100-125	7.0	16.8	.735	61.0			212-257
125-150	7.0	23.8	.758	55.2			257-302
150-175	6.3	30.1	.776	50.9			302-347
175-200	5.2	35.3	.792	47.2			347-392
200-225	5.4	40.7	.809	43.4			392-437
225-250	5.9	46.6	.823	40.4			437-482
250-275	5.7	52.3	.837	37.6			482-527
Vacuum distillation at 40 mm.							
Up to 200	3.6	3.6	.858	33.4	41	10	Up to 392
200-225	5.1	8.7	.862	32.7	47	25	392-437
225-250	5.1	13.8	.880	29.3	60	45	437-482
250-275	4.9	18.7	.891	27.3	95	65	482-527
275-300	5.0	23.7	.900	25.7	180	80	527-572

Carbon residue of residuum, 6.9%. Carbon residue of crude, 1.6%.

Approximate Summary

	Per cent	Sp. gr.	°A.P.I.	Viscosity
Light gasoline	9.8	0.688	74.2	
Total gasoline and naphtha	35.3	.742	59.2	
Kerosene distillate	11.3	.816	41.9	
Gas oil	13.2	.851	34.8	
Nonviscous lubricating distillate	9.1	.867- .891	31.7-27.3	50-100
Medium lubricating distillate	7.1	.891-.904	27.3-25.0	100-200
Viscous lubricating distillate	..	...	...	Above 200
Residuum	23.2	.951	17.3	
Distillation loss	0.8	...	...	

SAMPLE NUMBER 27381

Oklahoma	Searight	Field	Seminole County
Sinclair Oil and Gas Co.		Polly Well No. 2	
Section 3-9N-6E Indian		Hunton Lime, 4.055-4,155 ft.	
Specific gravity, 0.834		A. P. I. gravity, 38.2°.	
Per cent sulphur, 0.24.		Per cent water, trace.	
Saybolt Universal vis. at 70°F., 46 sec.		Pour point below 5°F.	
Saybolt Universal vis. at 100°F., 41 sec.		Color, green	

Distillation, Bureau of Mines Hempel Method

Air Distillation Barometer, 730 mm. First Drop: 32°C. (90°F.)

Temp'ture °C	Per Cent cut	Sum Per cent	Sp. gr. of cut	°A. P. I. of cut	Viscosity at 100°F.	Cloud Test, °F.	Temperature °F.
Up to 50	1.4	1.4)					Up to 122
50- 75	4.6	6.0)	0.671	79.4			122-167
75-100	4.3	10.3	.715	66.4			167-212
100-125	7.0	17.3	.736	60.8			212-257
125-150	7.6	24.9	.755	55.9			257-302
150-175	5.3	30.2	.775	51.1			302-347
175-200	5.8	36.0	.792	47.2			347-392
200-225	5.2	41.2	.809	43.4			392-437
225-250	5.2	46.4	.823	40.4			437-482
250-275	6.2	52.6	.836	37.8			482-527
Vacuum distillation at 40 mm.							
Up to 200	3.4	3.4	.855	34.0	41	10	Up to 392
200-225	5.4	8.8	.860	33.0	48	25	392-437
225-250	4.1	12.9	.876	30.0	61	45	437-482
250-275	4.1	17.0	.887	28.0	93	60	482-527
275-300	5.3	22.3	.899	25.9	185	75	527-572

Carbon residue of residuum, 6.0%. Carbon residue of crude, 1.4%.

Approximate Summary

	Per cent	Sp. Gr.	A. P. I.	Viscosity
Light gasoline	10.3	0.689	73.9	
Total gasoline and naphtha	36.0	.741	59.5	
Kerosene distillate	10.4	.816	41.9	
Gas oil	13.1	.848	35.4	
Nonviscous lubricating distillate	8.4	.863- .888	32.5-27.9	50-100
Medium lubricating distillate	5.1	.888- .901	27.9-25.6	100-200
Viscous lubricating distillate	1.9	.901-.906	25.6-24.7	Above 200
Residuum	23.6	.945	18.2	
Distillation loss	1.5	...	...	

SAMPLE NUMBER 27378

Oklahoma	Searight	Field	Seminole County
Carter Oil Co.		B. O. Kiker Well No. 1	
Section 2-9N-6E Indian	Earlsboro	Sand, 3,534-3,570 feet	
Specific gravity, 0.833		A. P. I. gravity, 38.4°.	
Per cent sulphur, 0.20.		Per cent water, nil.	
Saybolt Universal vis. at 70°F., 46 sec.		Pour point below 5°F.	
Saybolt Universal vis. at 100°F., 44 sec.		Color, green	

Distillation, Bureau of Mines Hempel Method

Air Distillation. Barometer 733 mm. First Drop: 34°C (93°F.)

Temp'ture °C	Per Cent cut	Sum Per cent	Sp. gr. of cut	°A. P. I. of cut	Viscosity at 100°F.	Cloud Test, °F.	Temperature °F.
Up to 50	1.7	1.7	0.645	87.9			Up to 122
50- 75	3.3	5.0	.666	81.0			122-167
75-100	6.3	11.3	.707	68.6			167-212
100-125	7.3	18.6	.734	61.3			212-257
125-150	6.3	24.9	.755	55.9			257-302
150-175	6.2	31.1	.775	51.1			302-347
175-200	4.7	35.8	.790	47.6			347-392
200-225	5.5	41.3	.807	43.8			392-437
225-250	5.2	46.5	.821	40.9			437-482
250-275	6.0	52.5	.834	38.2			482-527
Vacuum distillation at 40 mm.							
Up to 200	3.6	3.6	.855	34.0	41	15	Up to 392
200-225	5.6	9.2	.860	33.0	48	25	392-437
225-250	5.1	14.3	.877	29.9	63	45	437-482
250-275	4.6	18.9	.888	27.9	100	60	482-527
275-300	4.6	23.5	.900	25.7	195	80	527-572

Carbon residue of residuum, 5.3%. Carbon residue of crude 1.3%.

Approximate Summary

	Per cent	Sp. Gr.	A. P. I.	Viscosity
Light gasoline	11.3	0.686	74.8	
Total gasoline and naphtha	35.8	.737	60.5	
Kerosene distillate	10.7	.814	42.3	
Gas oil	13.2	.847	35.6	
Nonviscous lubricating distillate	9.4	.862- .888	32.7-27.9	50-100
Medium lubricating distillate	4.9	.888- .901	27.9-25.6	100-200
Viscous lubricating distillate	2.0	.901- .906	25.6-24.7	Above 200
Residuum	24.0	.941	18.9	
Distillation loss	0.0	...	...	

SAMPLE NUMBER 27379

Oklahoma	Earlsboro	Field	Seminole County
Magnolia Petroleum Co.		Seay Well No. 1	
Section 12-9N-5E Indian	Earlsboro	Sand, 3,417-3,460 feet.	
Specific gravity, 0.824		A. P. I. gravity, 40.2°.	
Per cent sulphur, 0.25		Per cent water, nil.	
Saybolt Universal vis. at 70°F., 43 sec.		Pour point, below 5°F.	
Saybolt Universal vis. at 100°F., 42 sec.		Color, green.	

Distillation, Bureau of Mines Hempel Method

Air Distillation. Barometer, 734 mm. First Drop: 32°C. (90°F.)

Temp'ture °C	Per Cent cut	Sum Per cent	Sp. gr. of cut	°A. P. I. of cut	Viscosity at 100°F.	Cloud Test, °F.	Temperature °F.
Up to 50	2.9	2.9	0.641	89.3			Up to 122
50- 75	4.1	7.0	.663	81.9			122-167
75-100	6.2	13.2	.702	70.1			167-212
100-125	7.1	20.3	.730	62.3			212-257
125-150	6.3	26.6	.750	57.2			257-302
150-175	5.7	32.3	.769	52.5			302-347
175-200	5.6	37.9	.787	48.3			347-392
200-225	4.8	42.7	.804	44.5			392-437
225-250	5.3	48.0	.819	41.3			437-482
250-275	5.8	53.8	.833	38.4			482-527
Vacuum distillation at 40 mm.							
Up to 200	3.3	3.3	.854	34.2	41	10	Up to 392
200-225	5.5	8.8	.860	33.0	47	25	392-437
225-250	5.2	14.0	.874	30.4	61	45	437-482
250-275	3.6	17.6	.887	28.0	95	60	482-527
275-300	5.2	22.8	.897	26.3	185	80	527-572

(Continued on page 80)

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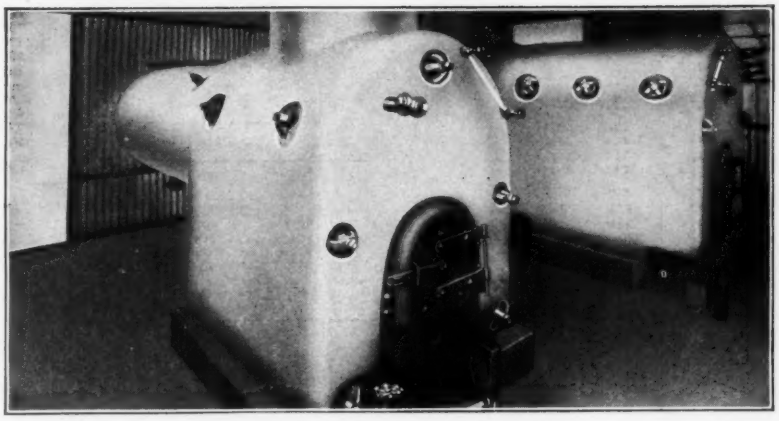
—Adheres to Hot or Cold Surfaces



Boiler Room in the Mid-Continental Oil Field

WEBERS No. 48 Insulating Cement was developed and perfected especially for use in oil refineries and power plants where high temperatures are encountered.

That it has met the exacting requirements of these industries is evidenced by the fact that it is now in use in the largest power plants and the greatest refineries in the country.

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Please Send Sample Bag of Weber's No. 48 Insulating Cement and Valuable Booklet on Insulation.

Name_____

Company_____

Address_____

City_____ State_____

Carbon residue of residuum, 5.4%. Carbon residue of crude, 1.2%.

Approximate Summary

	Per cent	Sp. Gr.	A. P. I.	Viscosity
Light gasoline	13.2	0.676	77.8	
Total gasoline and naphtha	37.9	.729	62.6	
Kerosene distillate	10.1	8.12	42.8	
Gas oil	13.1	.847	35.6	
Nonviscous lubricating distillate	8.8	.863- .888	32.5-27.9	50-100
Medium lubricating distillate	4.9	.888- .899	27.9-25.9	100-200
Viscous lubricating distillate	1.8	.899- .903	25.9-25.2	Above 200
Residuum	22.5	.946	18.1	
Distillation loss	0.9	...	...	

SAMPLE NUMBER 27243

Oklahoma	Seminole Field	Seminole County
T. B. Slick Oil Co.	Franks Well No. 8	
Section 35-9-6 Indian	Cromwell sand (?) 3503-3517 ft.	
Specific gravity, 0.836	A. P. I. gravity, 37.8	
Per cent sulphur, 0.14	Per cent water, nil.	
Saybolt Universal vis. at 70°F., 52 sec.	Pour point below 5°F.	
Saybolt Universal vis. at 100°F., 47 sec.	Color, green.	

Distillation, Bureau of Mines, Hempel Method

Air Distillation. Barometer, 744 mm. First Drop: 29°C. (84°F.)

Temp'ture °C	Per Cent cut	Sum Per cent	Sp. gr. of cut	°A. P. I. of cut	Viscosity at 100°F.	Cloud Test, °F.	Temperature °F.
Up to 50	2.6	2.6)					Up to 122
50- 75	2.0	4.6)	0.663	81.9			122-167
75-100	5.7	10.3	.717	65.9			167-212
100-125	6.9	17.2	.740	59.7			212-257
125-150	5.6	22.8	.760	54.7			257-302
150-175	5.0	27.8	.777	50.6			302-347
175-200	4.5	32.3	.791	47.4			347-392
200-225	4.6	36.9	.804	44.5			392-437
225-250	5.5	42.4	.818	41.5			437-482
250-275	6.0	48.4	.832	38.6			482-527
Vacuum distillation at 40 mm.							
Up to 200	2.7	2.7	.853	34.4	41	5	Up to 392
200-225	5.5	8.2	.856	33.8	47	20	392-437
225-250	4.8	13.0	.871	31.0	61	40	437-482
250-275	4.3	17.3	.883	28.8	91	60	482-527
275-300	5.4	22.7	.894	26.8	165	80	527-572

Carbon residue of residuum 5%. Carbon residue of crude 1.4%.

Approximate Summary

	Per Cent.	Sp. Gr.	°A. P. I.	Viscosity
Light gasoline	10.3	0.693	72.7	
Total gasoline and naphtha	32.3	.741	59.5	
Kerosene distillate	10.1	.812	42.8	
Gas oil	12.6	.844	36.2	
Nonviscous lubricating distillate	9.2	.859-.884	33.2-28.6	50-100
Medium lubricating distillate	6.9	.884-.900	28.6-25.7	100-200
Viscous lubricating distillate	..	....	....	Above 200
Residuum	28.2	.934	20.0	
Distillation loss	0.7	....	....	

SAMPLE NUMBER 26566

Oklahoma	Seminole Field	Seminole County
Base of Viola Limestone	4171-4256 ft.	
Specific gravity, 0.844	A. P. I. gravity, 36.2	
Per cent sulphur, 0.47	Per cent water, nil	
Saybolt Universal vis. at 70°F., 48 sec.	Pour point below 5°F.	
Saybolt Universal vis. at 100°F., 45 sec.	Color, browninsh-black	

Distillation, Bureau of Mines Hempel Method

Air Distillation Barometer 747 mm. First Drop: 43°C. (109°F.)

Temp'ture °C	Per Cent cut	Sum Per cent	Sp. gr. of cut	°A. P. I. of cut	Viscosity at 100°F.	Cloud Test, °F.	Temperature °F.
Up to 50							Up to 122
50-75	1.8	1.8)					122-167
75-100	5.6	7.4)	0.713	67.0			167-212
100-125	7.7	15.1	.735	61.0			212-257
125-150	6.6	21.7	.755	55.9			257-302
150-175	6.5	28.2	.774	51.3			302-347
175-200	6.5	34.7	.793	46.9			347-392
200-225	5.7	40.4	.809	43.4			392-437
225-250	5.9	46.3	.825	40.0			437-482
250-275	6.1	52.4	.839	37.2			482-527
Vacuum distillation at 40 mm.							
Up to 200	3.9	3.9	.867	31.7	42	28	Up to 392
200-225	4.8	8.7	.872	30.8	47	50	392-437
225-250	5.7	14.4	.887	28.0	60	65	437-482
250-275	4.0	18.4	.904	25.0	91	78	482-527
275-300	5.7	24.1	.921	22.1	168	92	527-572

Carbon residue of residuum 10.5%. Carbon residue of crude 2.4%.

Approximate Summary

	Per Cent.	Sp. Gr	°A. P. I.	Viscosity
Light gasoline	7.4	0.713	67.0	
Total gasoline and naphtha	34.7	.752	56.7	
Kerosene distillate	11.6	.817	41.7	
Gas oil	13.8	.856	33.8	
Nonviscous lubricating distillate	9.3	.876-.906	30.0-24.7	50-100
Medium lubricating distillate	6.2	.906-.928	24.7-21.0	100-200
Viscous lubricating distillate	0.9	.928-.931	21.0-20.5	Above 200
Residuum	23.2	.963	15.4	
Distillation loss	0.3	....	....	

Reports of Investigations, Bureau of Mines, Department of Commerce.

Ten Hints From One Suggestion Box

IN a number of petroleum refineries in this country "Suggestion Boxes" are conveniently located about the plant, so that the employe who has any ideas or suggestions that would tend to increase plant efficiency or safety, or be beneficial to the company in any way whatsoever, writes such suggestions on a sheet of paper and thus definitely brings them to the attention of the company management. In many cases, companies give a cash bonus to those employes whose ideas or suggestions are accepted and, consequently, the workman has an additional incentive for endeavoring to make worthwhile suggestions.

In some plants foremen are excluded from placing written suggestions in the "Suggestion Box," this being particularly true in cases where cash awards are given. In other cases, both the foremen and the subordinate employe are on an equal basis in submitting any ideas they may have to the company management for consideration.

The present article is based upon 10 different suggestions, referring mostly to refinery operation and management, selected from a number of ideas that appeared over a period of time in the "Suggestion Box" at one refinery. It is trusted that among these suggestions will be found some ideas or hints that will be suggestive to the interested reader as to improvements or changes that might be made in the operation of his own particular refinery which would prove beneficial.

General Accounting Suggestions

1. "In connection with a cost-accounting system a budget should be worked out for each department. Preferably this should be on a six-months basis. If sufficient crude supply is available, this should be planned on the basis of the refineries' operating at maximum capacity at all times, since—because the overhead expense is the same—operation at full capacity gives a lower unit cost.

"Laboratory experimental costs including both labor and material would thus be budgeted, as would also the cost of routine control work; also, all the shops, pressure stills, crude stills, agitators, various units in lube plant, etc.

"In other words, the whole refinery operation would be budgeted for six-month periods, both as to quantity of crude needed to keep the plant at full operation, amount to be expended in operation of each unit, and quantity and kind of products made."

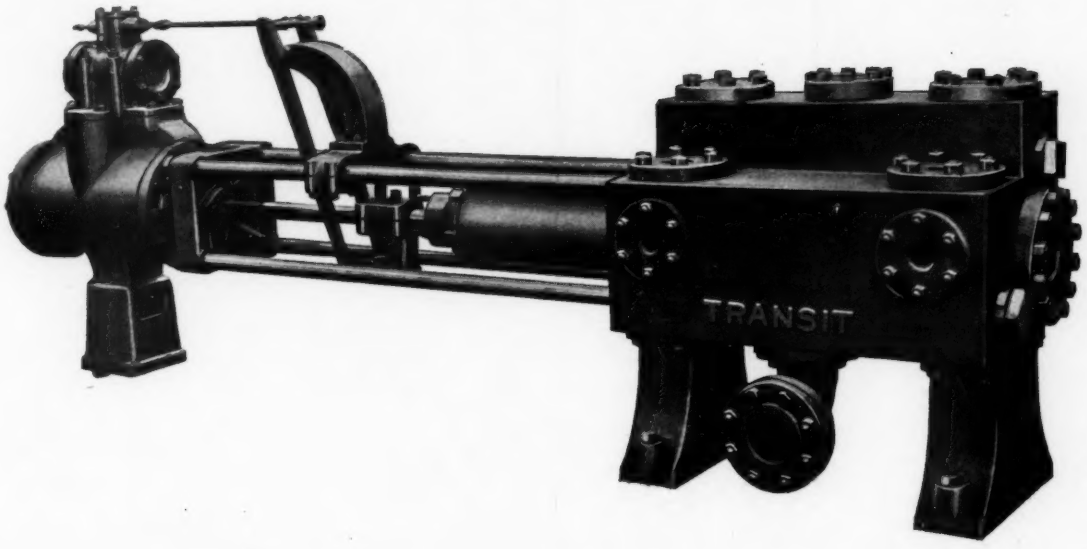
2. "In connection with a budgeting and a cost-accounting system, it is suggested that laboratory research and experimental work be budgeted and both labor and material be charged to each individual type of experimental work.

"The amount to be expended during any one year on any particular problem would depend upon the company's attitude toward research and experimental work. The advantage of so budgeting and keeping separate charge accounts on each problem is to see whether money expended in such work has been profitably spent; that is, whether it has brought savings in plant operation to more than pay for the cost of the experimental work that has been done.

"For example, the Sharples pilot plant and laboratory work done in connection with dewaxing residuums would thus be budgeted, given a "Charge Number" and cost of all labor

TRANSIT HOT OIL PUMPS

The "Spare" Idea



Many refinery engineers use the "spare" idea to insure continuous hot oil pump operation. That is, an extra pump of equal capacity to any other of the hot oil pumps is installed. Generally this extra pump is kept in operation, and a slow speed, easy running and consequently long lived installation is the result. When it is necessary to shut down one of the hot oil pumps, the capacity of the remaining pumps, or pump is sufficient for the needs.

TRANSIT Single Steam Hot Oil Pumps are fitted with an improved steam valve gear, positive in action, no dead center and no short stroking. Tie-bar construction cuts down the weight and renders the stuffing boxes easier of access.

These features together with the reasonable price of these pumps, make them very popular for this work.

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and material expended in such experimental work would be kept separately.

"Likewise, work in connection with the operation of the filter plant, experimental and research work on different clays and their treatment would be budgeted and given a separate "Charge Number."

"Also, experimental work done in treating oil with acid would be kept separately. In other words, any problem that involves the expenditure of considerable labor and material in experimental work and on which it could later be learned in plant operation whether or not that experimental work has been worth while would be budgeted and a separate charge account kept thereof.

"Such a system is in use in many laboratories and helps answer the question of the person responsible for the profits or losses of the company: "Does research and experimental work pay?"

3. "In connection with a cost-accounting system, to insure proper distribution of laboratory costs, it is suggested that arrangements be made for crediting the laboratory and debiting the department outside the refinery for costs of making tests and analyses on samples of oil or other products or materials that have no bearing on refinery operation, but which have been sent in to the refinery laboratory by an outside department for tests.

"This would cover such work as crude oil analyses from the field department, gas analyses, etc., from the gas department, laboratory work conducted for the benefit of the sales department, etc.

"The total cost of such work should be that of the labor for making the tests plus a charge) preferably a percentage of the labor cost) for use of laboratory apparatus and equipment.

"Such a credit and debit arrangement is followed by many companies where accurate laboratory costs as compared to costs of operation are desired."

4. "Arrangements should be made either for the warehouse to carry hydrometers, thermometers, (both tank and plain), etc., in stock or else a suitable method should be worked out for the laboratory to get credit for such material as is taken out of laboratory stock for use in the different units of the plant. The latter method is believed to be preferable."

Stock and Yield-Accounting Suggestions

5. "A temperature correction chart should be used), both for plant inventories and for shipments), that conforms to the coefficients of expansion for products of different gravities as worked out by the Bureau of Mines. This would give correct figures for plant inventories and would remove the cause for many of our apparent losses and gains—particularly in the Sharples plant. This would be especially helpful in connection with the functioning of the cost-accounting system."

6. "Stock numbers should be given different grades of lubricating oils to simplify general accounting work, shipping orders, yield and cost accounting, etc.

"For example, a 200 viscosity at 100 oil of 4 color could be called 2004; and a 300 viscosity at 100 of 5 color—3005.

"An 80 at 210 viscosity oil of 7 color, 807; a 190 at 210 viscosity oil of 8 color, 1908; etc. Such a numbering system, however, does not give a person any idea of the cold test or flash on the finished oil, but this is **not** essential.

"For convenience in daily inventory and laboratory records, numbers or combinations of numbers and letters should be worked out for products in the filter-house tanks, and all Sharples plant tanks—particularly in the latter, where the oil is in different unfinished stages of processing."

Operating Suggestions

7. "An operating committee should meet at regular periods (preferably once a week) with the General Superintendent, and Processing Superintendent for discussion of operating problems This committee should consist of the foremen of the following units:

"Laboratory, Crude Stills, Agitators, Pressure Stills, Filter House, Sharples Plant, Barrel House, Loading Rack, Gas Plant, also shipping clerk and person or persons responsible for cost-accounting and yield data."

8. "A specification book should be in use at all refineries as an assistance to the Sales Department and to the refinery in the standardization of all products shipped. This book should be prepared jointly by members of the Refining and Sales Department and should show the limits on the different physical tests for each product shipped. The standards set should be such as would allow the refinery to meet the average competition, but always there should be kept in mind whether or not the product when made to conform to the standards set is being made at a cost that would allow the refinery a margin for profit on that particular product"

Personnel and Employes' Welfare Suggestions

9. "To insure a better feeling among employes, that employment with this company carries with it opportunities for the future, it is suggested that a definite company policy concerning advances in wages and salaries—up to a certain limit for each grade—be adopted. By such a policy, if there were no chance for a man for advancement to a job of greater responsibility (and therefore more pay) and his work was satisfactory, length of service would have some bearing upon his rate of pay.

"For example, under such a policy, almost every employe would start to work either in the labor or pipe gang, the rate of pay of both being the same. If a man made good on that job and there was an opening in the operating department as a pumper's helper, this would constitute an advancement—a little more responsibility—and therefore deserving of a slightly higher rate of pay. If after six months of absolutely satisfactory service in the labor or pipe gang there had been no chances for advancement, then that man's services are more valuable to the company because of his service record by at least 2½ per cent per hour.

"This same idea could be carried through all jobs in all departments—but a minimum and maximum rate for each job would have to be established.

"Such a company policy is not new or novel, but is and has been in use and has been found successful by a great percentage of our large industrial concerns.

"In this connection it is suggested that a committee of from five to seven employes be appointed and meet from time to time for a discussion of our wage scale here; to discuss their uniformity or lack of uniformity, and what could or should be done toward making jobs in different departments, carrying about the same responsibilities worthy of approximately the same rate of pay."

10. "To promote better feeling on the part of the employes toward the company and the town, it is suggested that information be secured and published concerning living conditions both here and in towns and cities over the country where refineries are located and rates of pay for refinery employes in those towns and cities—these rates to cover all the main different jobs that exist in a refinery.

"If such a survey of economic conditions should show that the margin between rate of pay and cost of living here is either more or less than the average of conditions elsewhere, then it would be only proper to take whatever steps would be necessary to make the differential between rate of pay and cost of living here in the same percentage ratio as exists elsewhere."

There is no doubt but that the use of "Suggestion Boxes" placed at convenient points about the refinery is an act worth doing on the part of every refinery management, although, true enough, the success or failure of the venture depends entirely on the interest that the employe can be urged to take in such a suggestion box. As previously stated, the giving of cash awards, for example, five or ten dollars for all suggestions that are accepted—that is, later put into effect, is one method of stirring the employe into action. Contests between departments for the greatest number of suggestions accepted is another method.

It is generally found that a large percentage of the written memorandums placed in the Suggestion Box refer to means whereby the plant can be made "safer" for the employe. However, such ideas for improving "Plant Saefty" are o fjust as much importance as any suggestions relating to new operating methods or procedures, new equipment, or any other means for increasing plant efficiency, and, consequently, such "Safety Suggestions" are welcomed by the company management equally with the others.

1 Reduced repairs and replacements

How to effect it 2

You can't help making some repairs and replacements in stills and boilers. If you reduce the *frequency* with which these are made, of course you reduce your overhead and operating costs and increase your efficiency.

It has been definitely shown that Pittsburgh Seamless tubes will reduce the number of replacements during the year. This is because, making nothing but seamless tubing and devoting our entire resources to that work, we produce flawless tubing of only the highest quality.

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There are no weak points in Pittsburgh Seamless. Consequently it will stand up longer under the severe strain and appreciably cut down the cost of repairs and replacements.

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For over 20 years our entire resources have been on one objective—how to make a better seamless tube. Today our methods are the most up-to-date that engineers and scientists have developed. Due to this carefully concentrated attention on only one type of tubing, we have become the largest company in America devoted exclusively to its manufacture.

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Why not adopt them now and benefit by their greater safety and economy.

Mention Where You Saw the Advertisement

N. P. A. Department Personnel Announced

Washington, D. C.—Following the annual meeting of the National Petroleum Association in Atlantic City, September 14, 15 and 16, the appointments have been made to complete the department personnel of the organization.

Officials are elected, while the department trustees and councillors are appointed by the president. The official roster of the organization follows:

Officials—E. M. Lyons, president; P. S. Tarbox, first vice president; H. A. Logan, second vice president; Fayette B. Dow, general counsel; C. D. Chamberlin, advisory counsel; Willis Crane, traffic attorney; Herbert G. Eaton, recording secretary; G. B. Hunter, treasurer.

Trustees—Fred G. Clark, Fred G. Clark Company; Sheldon Clark, Sinclair Refining Company; G. C. Davison, Tri-State Refining Company; Frank B. Fretter, National Refining Company; Howard H. Greene, Kendall Refining Company; T. J. Hilliard, Waverly Oil Works Company; O. P. Keeney, Keeney Oil Company; H. A. Logan, United Refining Company; E. M. Lyons, Tiona Refining Company; A. W. Scott, Empire Oil Works; P. S. Tarbox, Independent Refining Company; R. A. Wotowitch, Henry L. Doherty & Company.

1. *Economics, Accounting and Statistics.*

P. S. Tarbox, trustee in charge. Councillors: F. W. Alcorn, Penzoil Company; George S. Ayres, United Refining Company; Clarence J. Fox, Emlenton Refining Company; M. I. Landa, Empire Refineries, Inc., address, 60 Wall Street, New York; H. W. Ralph, Indian Refining Company; associate councillor, C. J. Leroux, Paragon Refining Company.

2. *Legislation and Litigation.*

Sheldon Clark, trustee in charge. Councillors: George P. Brockway, Seneca Oil Works; Frank R. Coates, Henry L. Doherty & Company; M. F. Cowden, Penna. Oil Products Refining Company; Samuel Messer, James B. Berry Sons' Company, Inc.; J. Howard Pew, Sun Oil Company.

3. *Manufacture.*

Howard H. Greene, trustee in charge. Councillors: D. W. Hovey, Waverly Oil Works; J. W. Griswold, Crew Levick Company; Harry R. Lewis, Conewango Refining Company; J. B. Northrup, Ohio Valley Refining Company; W. S. Zehrung, Pennzoil Company; associate councillors, F. J. McGraw, Oil Creek Refining Company; Frank F. Moore, McKean County Refining Company; T. M. Murphy, W. H. Daugherty & Son Refining Company; B. B. Stroud, Bradford Gasoline Corporation; A. B. Weingard, American Oil Works.

4. *Membership and Relations.*

O. P. Keeney, trustee in charge. Councillors: Louis Carruth, Canfield Oil Company; John S. Cordell, Cities Service Refining Company; Lewis C. Jamieson, Viking Oil Corporation; H. B. Seltzer, Tri-State Refining Company; A. C. Woodman, Acewood Petroleum Corporation.

5. *Standards and Tests.*

A. W. Scott, trustee in charge. Councillors: E. E. Bown, Emery Manufacturing Company; F. W. Breth, Franklin Creek Refining Company; MacLean Houston, United Refining Company; E. M. Keely, Crew Levick Company; R. C. Osterstrom, Pure Oil Company; associate councillor, W. T. Sieber, Waverly Oil Works Company.

6. *Trade and Commerce.*

H. A. Logan, trustee in charge. Councillors: D. J. Cavanaugh, Pennzoil Company; L. L. Long, Waverly Oil Works; W. A. McCafferty, Emery Manufacturing Company; Harry W. Schmidt, United Refining Company; G. G. Woodruff, Roxana Petroleum Corporation; associate councillors, A. F. Anderton, Continental Refining Company; R. G. Browne, Great Western Oil Company; Myron Evans, Island Petroleum Company; Wayne B. Glenn, Pennsylvania Refining Company; Frank C. Hart, Hartol Products Corporation; T. C. Hawkey, Tidioute Refining Company; James Lewis, Bradford Oil Company G. R. Nutty, Gulf Refining Company.

7. *Traffic and Transportation.*

Frank B. Fretter, trustee in charge. Councillors: D. E. Carrier, Pennzoil Company; E. E. Harrington, National Refining Company; Henry Hauseman, Pure Oil Company; W. W. Klingensmith, Transcontinental Oil Company; J. M. O'Day, Sinclair Refining Company.

8. *Welfare and Insurance.*

R. A. Wotowitch, trustee in charge. Councillors: Frank G. Benedict, Sinclair Refining Company; Earle M. Craig, Freedom Oil Works Company; Harold Eaton, Valvoline Oil Corporation; Frank A. Epps, Tide Water Oil Company; J. W. Fawcett, Crystal Oil Works; associate councillors, Houston Dunn, National Petroleum Mutual Fire Insurance Company; H. F. Heilman, Levi Smith Refining Company; James H. Herbert, Conewango Refining Company; J. B. Miller, A. D. Miller Sons' Company; S. D. Tibbits, Warr-Penn Refining Company; F. B. von Tacky, Titusville Oil Works.

Carriers to Be Asked to Keep Present Mid-Continent Rates

Tulsa, Okla.—Kansas and Oklahoma refiners will now seek rate relief from the carriers serving the territory recently designated as "Group 3" by the Interstate Commerce Commission. The revised decision of "Mid-Continent Oil Rates, 1925," came October 12, placing Central Kansas refining centers with Oklahoma in a new Group 3, leaving Southeastern Kansas, Missouri and a section of Northeastern Oklahoma in Group 2.

Several meetings of Mid-Continent refiners followed and it has been decided to gain the consent of the railway companies not to put the maximum charges in effect as set up in the revised decision. Instead it is hoped to have rates remain as they have been for several years past. The carriers, however, will be forced, in case they do consent, to lower rates in the new Group 2, to meet the differential specified in the revised decision.

The committee named to seek the consent of carriers is composed of Jacob France, president of the Mid-Continent Petroleum Corporation; W. G. Skelly, president of the Skelly Oil Company; L. L. Marcell, president of the White Eagle Oil & Refining Company; E. W. Marland, president of the Marland Refining Company; E. B. Reeser, president of the Barnsdall Refineries, Inc., and P. M. Miskell, manager of the Empire Refineries, Inc.

Briefly, the history of this rate case is: A decision of last spring put Kansas refining centers in possession of a rate differential so high that Oklahoma refiners put up a determined fight and succeeded in getting the matter before the Interstate Commerce Commission again.

Then October 12 the commission issued its revised decision. It changed the previous decision, placing Central Kansas refining points, such as El Dorado, Potwin, Wichita and Arkansas City, in Group 3, with Oklahoma refining centers. Group 2 was designated as territory within 385 miles of St. Louis. The refining points of this territory are Humboldt, Chanute, Neodesha and Coffeyville, Kansas, and Joplin, Missouri.

As the decision of last spring was unsatisfactory to Oklahoma refiners, the revised decision found disfavor from both Oklahoma and Kansas refiners, except those within the Group 2 territory in the southeastern part of the State. The several meetings here resulted in the decision to carry the matter to the carriers, since the refiners are convinced that the Interstate Commerce Commission is convinced that petroleum rates should be higher out of southwestern territory.

The carriers having lines into the Mid-Continent territory are generally favorable to rates that will not work a hardship on the industry. But to comply with the request to keep present tariffs, the southwestern carriers will be forced to have consent of carriers into the Western Trunk Line territory.

Protect your Steel Equipment from Atmospheric Corrosion by ZINCŌTING with METALAYER

METALAYER *is the result of over 10 years intensive research and experimentation, which entailed an expenditure of over $1,000,000.00. It has no competitors.*

METALAYER actually "drives-in" (impacts) MOLTEN METAL on any surface,—whether said surface be metallic, fibrous, vitreous, inflammable, conducting or insulating. It is ideal for applying metal coatings for resisting corrosion or chemical action, —or for filling up blowholes in castings,—or for salvaging mismachined parts, — or for obtaining durable and attractive decorative effects.

Any of the commercial metals can be applied (impacted) by METALAYER, *and such coatings may be turned, filed, ground or polished, etc., if desired.*

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R-11

Fuel Economy in Refineries*

By P. W. THOMAS
Combustion Equipment Company

Fuel efficiency and cost of fuel are secondary to the one great need of the refinery—maximum production per dollar of investment in plant. To think of fuel in any sense around the refinery, one must think first of the plant production, and next of any contemplated change in fuel or firing methods. It might be that a salesman could prove conclusively the efficiency of his combustion equipment but, if this higher efficiency were made at the expense of any part of output, it would not be considered as econimical. If, on the other hand, it gave the same output with reduced fuel percentage, it would be economical.

In another view of the situation—if certain fuel burning equipment raised the output of the plant, but also raised the fuel percentage, so that more fuel per barrel of output was consumed, I feel sure that most refineries would consider the equipment as desirable because of increased output, therefore truly economical. The ultimate goal is fuel economy in the refinery is such use of fuel that the production is increased and the fuel decreased —a seemingly impossible achievement.

To review the case, consider that the use of fuel may be divided as follows:

1. Fuel burned under boilers.
2. Fuel burned under stills.

We are all fairly familiar with methods of fuel economy in high pressure steam boilers. The theoretical maximum efficiency of such boilers ranges from 75 per cent to 80 per cent overall efficiency if oil or gas is burned. Any steam plant not obtaining these efficiencies can very quickly get them by installing good combustion equipment. One caution might be given at this point, namely, that steam generated at the highest possible boiler efficiency is often wasted quite freely so that, in many plants, a genuine reduction of fuel might be made by a more careful use of the steam itself. In this connection, I would suggest investigating the use of superheaters and condensation return appliances.

Shell Stills

The greater part of the refinery fuel is used under stills. Here fuel consumption varies greatly, depending upon the type of the still and character of the charge in the still. Shell stills, whether crude or re-run, are not and never will be truly economical of fuel. If the actual fuel percentage is low in a given plant, it is generally due to a greater use of steam in the still, so that more fuel must be burned under boilers. Here again, output rules. If greater production follows the use of steam, more steam will be used.

Methods of firing shell stills vary: some refinery apparently believe in what I would call a very bad fire; others attempt a very good fire. To my mind, the best results have followed a fairly careful furnace installation, designed to give a fire with from 75 per cent to 100 per cent excess air. Such a fire permits maximum transfer by radiation with a fair amount of direct connection and, in a still set 8 to 10 feet off the ground, gives a good lower sheet condition.

Pipe stills present a new condition for furnace work. These stills, equipped with heat exchangers, built carefully for certain work, require definite quantities of heat presented to their surfaces through the entire tube bank.

Cracking Stills

Cracking stills also have very definite limits within which heat may be transferred. As the limits are unusually low in initial temperature, and high in final temperature, under ordinary conditions these stills would not be economical in the use of fuel as, to obtain low initial temperature and increase the quantities of gases through the heating surface, a great deal of excess air would necessarily be used. Certain fuel savings in stills having high final temperatures can be made by using a recuperator. This is a heat exchanger designed to return some of the heat of the waste gases to the fire by exchanging it into the combustion air.

To bring the fuel down, and incidentally what is most important, to increase the quantities of gases passing the heating surface within a given temperature range, recirculation of flue gases is resorted to. The object of a recirculating system is two-fold. Its main idea is to increase the output of the still, both by actual heat transfer and by character of heat transfer. Its secondary object is to accomplish this increase with less fuel per barrel of output.

The first objective is reached simply enough. A proper recirculation system returns a quantity of flue gases to the fire, great enough that the fire is perfect in every respect, since the recirculated gases replace excess air. The flame proper is of high temperature, full of raidant heat. As the combustion gases merge with the lower temperature recirculation gases, a uniform mixture enters the tube bank, insuring fairly equal transfer by connection to each square foot of heating surface. At the same time, the quantity of radiant heat is diffused evenly over the primary heating surfaces. Properly proportioned, the amount of heat transferred by convection is made greater than that transferred by radiation so that a very even condition of transfer occurs in the heating surface. An even transfer insures that all the surface is working and that no one part is overworking. The result is, or should be, a greater daily output, with a longer cycle on the still, since less carbon will be formed in the lower tubes.

From what I have said up to this time, you might assume that the application of recirculation to cracking stills to accomplish maximum results is a simple matter. Quite on the contrary is true, as you will see from the following comparison of actual operating results in a Mid-Continent refinery.

Two cracking stills of the same type and size but equipped with different recirculation systems give the following average results:

	No. 1	No. 2
Daily output finished gasoline, bbls..	400	500
Initial temperature, degrees F.	1,400	1,400
Final temperature, degrees F.	1,000	1,100
Days on stream	7	12
Days on stream per month	24	28
Monthly production gasoline	9,600	14,000
Gain No. 2 over No. 1 per mo., bbls.....		4,400
Gain in per cent		46

Careful examination of these two units explain the difference in output in days on stream as follows:

Pyrometer readings taken at various points disclosed that the still with the low output and short cycle did not have a uniform gas mixture entering the tube bank. The still with the high output and long cycle has a very uniform temperature below its tubes from end to end, and indicated a passage of gas uniform in temperature and quantity.

The still having the short cycle had a severe "hot spot"—a narrow band of high temperature gases entering the heating surface. Also, it quite evidently had more radiant heat in the furnace, explained by the fact that it has a greater fuel consumption and more excess air than the still with the higher output.

Between radiant heat excess and the "hot spot," this still went considerably into vapor phase cracking, forming carbon rapidly and so remaining on stream not more than a week. In this short period, its daily output was limited by the fact that, even with excess air, it did not have sufficient gas quantities to work all of the heating surface. Therefore, the capacity of the still was cut by the failure to work part of the heating surface, and the cycle was shortened by overworking the remainder.

The second still, supplied uniform temperature and ample quantities of gases, with its initial temperature held down purely by recirculation, was enabled to maintain a higher output per day for 12 days on stream. This longer cycle is due to the reduction of radiant heat in the furnace, which means a lower rate of heat transfer per square foot of initial surface, and to the fact that convection was practically equal throughout the tube bank. Both these conditions reduce vapor phase cracking in the tubes insuring a longer cycle. It was observed that this still contained less hard carbon, being therefore more easily cleaned and more quickly re-

*Before technical meeting of the Western Petroleum Refiners Association, Wichita, Kansas, October 11, 1927.

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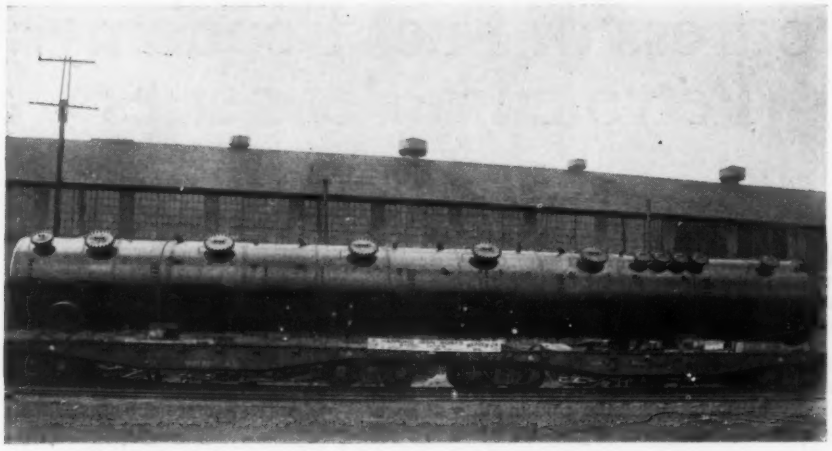

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turned on stream. This short cleaning period, coupled with the longer time on stream, accounts for the increased number of days on stream per month.

Recirculation represents the greatest advance that has ever been made in refinery fuel economy but its value is in direct proportion to the care and understanding with which the equipment is designed and applied.

With the introduction of recuperation and recirculation, and the extended use of heat exchangers, a very real fuel economy reaches the refiner. The possibilities of heat transfer are already affecting the design of stills very much. Stills of the future, using these new appliances, will be very economical of fuel.

Progress of Fuel Economy at Petroleum Refineries

By G. R. HOPKINS
U. S. Bureau of Mines

LIKE most industires, the refining industry has in recent years been confronted with a problem of a decreased margin of profit, due both to a general lowering of prices and to rising costs. This has resulted in accelerating a program of increased efficiency as evidenced by improved methods and the installation of equipment designed to effect a number of economies hitherto regarded as unimportant. Perhaps the most important of these has been that of fuel economy, for, as is not often realized, a refinery consumes about one-tenth as much fuel as it produces.

A recently completed canvass, made by the Bureau of Mines for the purpose of determining the trend of fuel consumption at refineries in the United States, showed the following outstanding points (1) a decrease in the use of oil for fuel in 1926 of approximately 4,000,000 barrels as compared with 1925; (2) a small decrease in the use of coal; (3) a material increase in the use of gas, both natural gas and refinery gas; and (4) a considerable increase in the use of petroleum coke.

The explanation of the decrease in the use of oil for fuel probably lies in the existence of a relatively strong fuel oil market in 1926. Wherever possible gas was substituted for oil. This was particularly evident in Texas, where the consumption of oil decreased over 3,000,000 barrels, or 21 per cent, while the consumption of natural and refinery gas increased 63 per cent.

Every section of the country showed a gain in the use of refinery gas for fuel. In constructing systems whereby still gases are recovered, the refineries have effected a two-fold economy—namely, a saving of gasoline recovered from the gas and a saving of fuel thorugh the burning of the residue gas.

As stated above, the quantity of coal used for fuel at refineries showed little change from 1925. Practically all of the coal is consumed in the eastern and central States, where natural gas is either lacking or prohibitive in price. The refineries of this area, therefore, were vitally interested in the matter of still-gas recovery, which they employed to obtain the fuel made necessary by increased operations.

Much attention has recently been given by refinery engineers to the problem of devising a thoroughly satisfactory burner to utilize the increasing production of pressure still coke. That some progress was made in 1926 would seem to be indicated by the fact that the consumption at refineries increased from 314,000 short tons in 1925 to 408,000 short tons in 1926, the latter figure being equivalent to over 40 per cent of the total output.

As is quite well known, cracking has become one of the most important phases of modern refinery practice. This process, which consists, in brief, of breaking down high-boiling fractions into lower boiling fractions by the application of heat, has by reason of the high temperature required, materially increased the fuel demand at refineries. Another factor which has tended to increase fuel consumption at refineries is the ever-growing practice of completely refining crude petroleum; that is, of recovering the lubricating, wax and asphalt fractions instead of leaving them in the fuel oil.

In spite of added fuel requirements, the refineries have by more efficient and economical practice succeeded in

Fuel Used at Refineries in the United States, 1925-1926.

	Oil* (Thousands of Bbls.)	Coal (Thousands of Short Tons.)	Gas (Million Cubic Feet) Natural	Gas (Million Cubic Feet) Refinery	Coke (Thousands of Short Tons	Other	Total B. t. u. (Billions Approx.)	Crude Runs to Stills (Thousands of Bbls.)	B. t. u. Per Bbl. Crude Run
1925—									
East coast	14,164	1,406	....	6,863	104	†	131,926	128,491	1,027,000
Appalachian	641	1,346	2,364	537	5	‡	42,038	25,118	1,674,000
Indiana, Illinois, etc.	2,997	3,077	....	5,505	33	¶	104,755	67,159	1,560,000
Oklahoma	2,552	1	25,670	3,295	....		45,751	61,837	740,000
Kansas and Missouri	3,021	229	5,955	3,175	6		33,846	35,775	946,000
Texas Inland	2,277	....	4,900	422	8		19,490	35,957	542,000
Texas Gulf Coast	13,189	....	12,956	7,354	79		102,830	108,325	949,000
Total Texas	15,466	....	17,856	7,776	87		122,320	144,282	848,000
Arkansas-Louisiana Inland	15	....	6,267	353	....		7,041	16,239	434,000
Louisiana Gulf Coast	4,920	....	....	2,518	59		33,934	50,758	668,000
Total Louisiana-Arkansas	4,935	....	6,267	2,871	59		40,975	66,997	612,000
Rocky Mountain	1,761	94	19,007	3,448	20		37,188	26,164	1,421,000
California	4,918	....	10,723	1,571	....		42,417	184,097	230,000
Total United States	50,455	6,153	87,842	35,041	314			739,920	813,000
Total B. t. u. (billions approx.)	302,730	159,978	92,234	36,793	9,420	61	601,216	....	....
1926—									
East coast	14,701	1,447	....	9,642	105		139,102	130,643	1,065,000
Appalachian	606	1,644	2,501	1,550	3	§	50,724	28,502	1,780,000
Indiana, Illinois, etc.	3,130	2,677	1	7,649	35	/	97,466	69,707	1,398,000
Oklahoma	2,010	6	25,957	5,425	7		45,377	61,409	739,000
Kansas and Missouri	2,085	226	8,048	3,478	5		30,638	35,097	873,000
Texas Inland	1,954	....	3,626	537	10		16,395	36,183	453,000
Texas Gulf Coast	10,325	....	25,121	12,370	127		105,126	119,927	877,000
Total Texas	12,279	....	28,747	12,907	137		121,521	156,110	778,000
Arkansas-Louisiana Inland	50	....	9,056	769	.....		10,616	19,507	544,000
Louisiana Gulf Coast	4,808	....	....	3,803	101		35,871	51,505	696,000
Total Louisiana-Arkansas	4,858	....	9,056	4,572	101		46,487	71,012	655,000
Rocky Mountain	1,496	52	30,720	4,126	15		47,366	29,205	1,622,000
California	5,251	....	16,419	2,728	....		51,611	197,579	261,000
Total United States	46,416	6,052	121,449	52,077	408			779,264	809,000
Total B. t. u. (Billions approx.)	278,496	157,352	127,522	54,681	12,240	1	630,292	.....	.....

*Includes acid sludge. †3,269 cords of wood. ‡72,632 kilowatts. ¶183,660 kilowatts. §102,901 kilowatts. /268,240 kilowatts.

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reducing the consumption of fuel per barrel of crude petroleum refined. In order to arrive at this conclusion the consumption of the various fuels were reduced to their B. t. u. equivalents according to the following factors:

Oil, 6,000,000 B. t. u. per barrel.
Coal, 26,000,000 B. t. u. per short ton.
Gas, 1050 B t. u. per cubit foot.
Coke, 30,000,000 B. t. u. per short ton.
One kilowatt hour, 3415 B. t. u.
Wood, 20,000,000 B. t. u. per cord.

These factors gave a total of about 630,000,000,000,000 B. t. u. used in 1926 as compared with 600,000,000,000,000 B. t. u. in 1925 and 305,000,000,000,000 B. t. u. in 1919. There were 361,520,000; 739,920,000; and 779,264,000 barrels of crude petroleum refined in 1919, 1925, and 1926, respectively, which indicates a requirement of 849,000 B. t. u. per barrel in 1919, of 813,000 in 1925, and of 809,000 in 1926. This decline over a number of years is indicative of the success which has attended fuel economy.

The Appalachian area used the greatest number of B. t. u. per barrel of crude refined; and California, the least. In the case of the former, the explanation undoubtedly lies in the great number of small refineries, most of which completely refine the crude oil run to stills. Furthermore, many of these refineries use coal, which ranks comparatively low in the percentage of B. t. u. recovered and used. The fuel requirements of the California refineries per barrel increased in 1926 but are still relatively low, owing to the widespread use of the skimming and topping processes.

Fuel economy has resulted largely from a policy of efficient use rather than through the installation of new apparatus using less fuel. Thus hot still-gases are made to preheat the air for fuel combustion and also the feed-water for boilers. Heat exchangers, a system by which cold liquids are made to do part of the work of the condensers, have lowered both fuel and water requirements. Exhaust steam is receiving its share of attention, being used to heat buildings, agitators, etc. Operations at the modern refinery are usually conducted on a continuous basis, in contrast to the batch system. One of the most common features associated with modern refinery practice and continuous operation is the pipe-still, which is not only a time saver but a fuel economizer as well.—Reports of Investigations, Bureau of Mines, Department of Commerce.

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California Meeting

Los Angeles.—The October meeting of the California Natural Gasoline association was held Thursday, October 20, with 223 members and visitors present. Martin Van Couvering read a lengthy paper on "Geology and Its Relationship and Importance to the Natural Gasoline Industry." Mr. Van Couvering touched lightly on the fundamentals of geology, especially as related to California fields. The paper was the first of a series which will show the relationship of oil to the natural gasoline industry. It was well received and a general discussion followed in which it was shown that the economic recovery of oil closely follows the profitable recovery of natural gas.

T. T. Rissinger of the Union Oil Company read a paper on "Direct Driven Reciprocating Pumps." The paper dealt with the early history of both the simplex and duplex pumps, as well as the construction and care of the modern pump.

Natural Gasoline Men to Have Chicago Program

Tulsa, Okla.—The Association of Natural Gasoline Manufacturers has been invited to prepare the program for the natural gasoline group meeting of the American Petroleum Institute, December 8, in Chicago. This meeting will not be held at the time of the regular gasoline group meeting, according to information at headquarters of the association here.

The Duriron Company, Dayton, Ohio, has issued a booklet giving complete information on the use of Duriron in oil refineries. The booklet is devoted exclusively to refinery installations and can be had upon request to the company at Dayton, Ohio.

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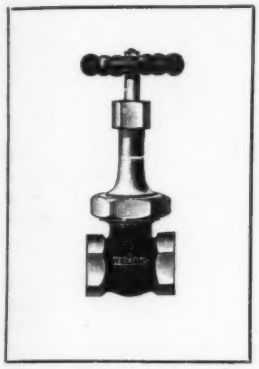

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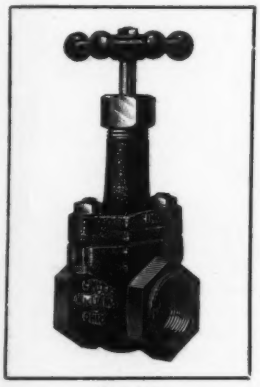

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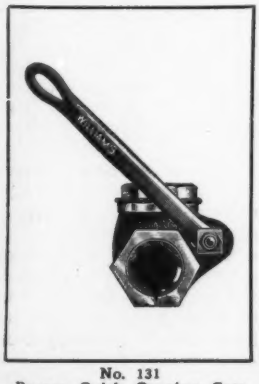

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By D. E. BUCHANAN
Vice-president, Chestnut & Smith Corp.

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We must admit that the petroleum industry has had its market handed to it on the proverbial silver platter. In fact we might say our market for gasoline has actually been forced upon us. We say much and hear much about the wonderful achievements of the industry in keeping pace with the tremendous increase in demand for gasoline, and indeed, the scientific development in the arts of finding and producing crude petroleum and the manufacturing of products therefrom is an industrial accomplishment second to none but, so far as marketing is concerned, surely we have done nothing of which we may be proud.

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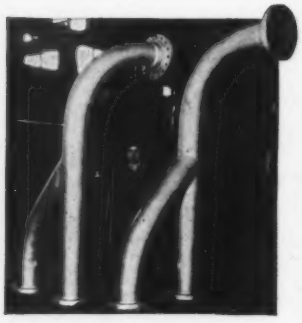

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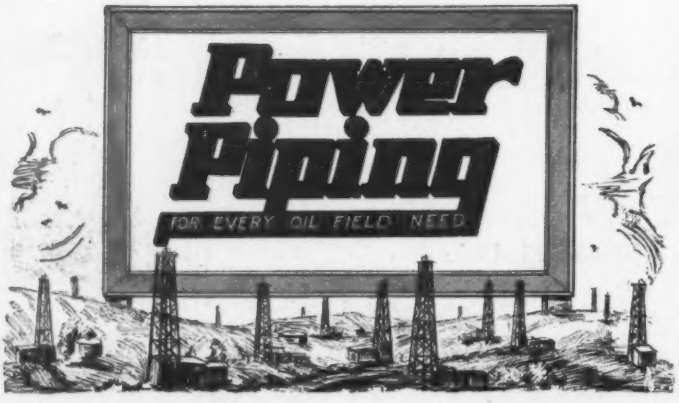

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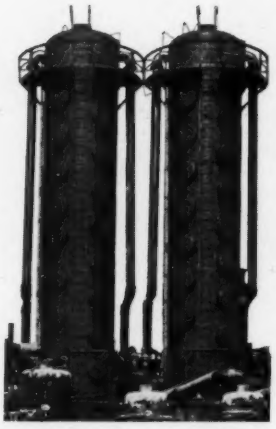

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Crystal Oil Refining Corp.,	Shreveport, La.	3	
Cross, Henry H. C. Company,	Joliet, Ill.	2	
Champlin Refining Co.,	Enid, Oklahoma	2	1
Derby Oil Co.,	Wichita, Kan.	4	4-1
Empire Refineries, Inc.,	Okmulgee, Okla.	2	2-1
	Ponca City, Okla.	2	2-3-1-1
	Gainesville, Texas	2	2-3-7
	Cushing, Okla.	2	
	Wichita, Kansas	1	
Galena Signal Oil Co.,	Galena, Texas	1	
Inter-Ocean Refining Co.,	Baltimore, Md.	6	
Garber Refinery, Inc.,	Garber, Okla.	4	2-2
Galena Signal Oil Co.,	Galena, Texas	1	
Independent Oil & Gas Co.,	Okmulgee, Okla.	5	
Inter-Ocean Refining Co.,	Baltimore, Md.	6	
Johnson Oil & Refining Co.,	Clevleand, Okla.	4	1
Kanotex Refining Co.,	Arkansas City, Kan.	1	4
Kent Middleton Refining Co.,	Minerva, Texas	1	2
	Angus, Texas	1	4
	Brownwood, Texas	2	
Kettle Creek Ref'g Co.,	ElDorado, Ark.	2	
Kentucky Oxygen Hydrogen Co.,	Louisville, Kentucky (Dexter)	1	
Lemont Refining Co.,	Lemont, Ill.	2	
Louisiana Oil Ref'g Corp.,	Shreveport, La.	2	
Lion Oil Company,	ElDorado, Ark.	3	

Purchaser—	Location—	Number of Towers On First Order	Number of Towers On Succeeding Orders
Louisville Pet. Ref'g Co.,	Louisville, Ky.	2	1-1
Magnolia Petroleum Co.,	Ft. Worth, Texas	12	
	Beaumont, Texas	14	
	Chaisen, Texas		
McColl Bros., Ltd.,	Toronto, Ontario	1	1
Medway Oil & Storage Co., Ltd.,	Isle of Grain, Kent, England	4	1
Ouachita Valley Ref'g Co.,	ElDorado, Ark.	1	1
Panhandle Ref'g Co.,	Wichita Falls, Texas	2	1
Peerless Oil & Refining Co.,	Chanute, Kansas	3	1
Pierce Oil Corporation,	Sand Springs, Okla.	2	
Peppers Gasoline Co.,	Covington, Okla.	3	1-1-1-2-1
Rock Island Ref'g Co.,	Duncan, Okla.	3	2
Roeser & Pendleton,	Albany, Texas	1	1
Root Refineries, Inc.,	ElDorado, Ark.	1	
Roxana Pet. Corp.,	Arkansas City, Kan.	2	
Shaffer Oil & Ref'g Co.,	Cushing, Okla.	2	5-2
Sinclair Ref'g Co.,	East Chicago, Ind.	1	
	Houston, Texas	2	
Skelly Oil Co.,	ElDorado, Kansas	2	1
Shreveport Producing & Ref'g Corp.,	Shreveport, La.	2	
Stellar Refining Co.,	Newark, Ohio	1	
Texhoma Refining Co.,	Wichita Falls, Texas	4	
Union Oil Co.,	Wilmington, Calif.	1	
Vickers Petroleum Co.,	Wichita, Kan.	2	
White Eagle Oil & Ref'g Co.,	Augusta, Kan.	3	
West Kansas Ref'g Co.,	Russell, Kan.	4	
Western Oil Corp.,	Duncan, Okla.	2	
Yale Oil Corp.,	Miles City, Montana	1	

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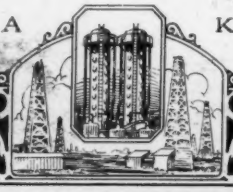

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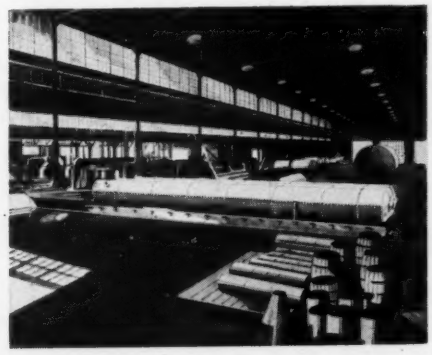
troubles, the need of prorating or curtailing production here and there, with practically nothing said about the need for developing additional and new markets. Most surely we need more orderly production today, primarily because our sales effort has not kept pace with the effort we have put into prospecting, producing and manufacturing. It is admitted by everyone that conservation does not mean locking up a natural resource for the use of a coming generation. Why, bless you, my great grandchildren, and I hope to have some, will probably not need petroleum. If we don't call off the scientists, our posterity will be grabbing electrical power out of the air and lubricating the wheels of industry with some waste product we now consider useless, and petroleum will be a back number, crushed under the wheels of progress, long before the supply is exhausted.

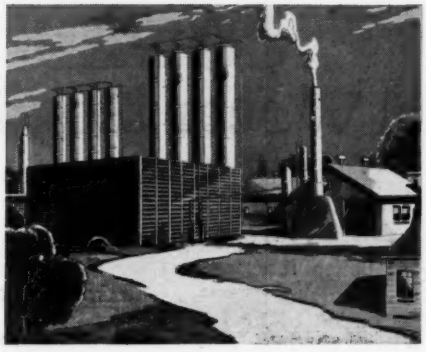
A few months ago the rubber producing interests of the world apparently had us "in the nine hole". For us the effect was just the same as if the supply of crude rubber was soon to be no more. Did we go back to joy riding on steel buggy tires? No, we started planting our own rubber trees and at the same time looking for a synthetic rubber as a substitute. We are perfectly secure in believing that we will always be able to buy balloon tires or something better, regardless of what happens to the supply of crude rubber. Nothing is impossible anymore. Before the supply of petroleum is exhausted, science will have developed some energy producing agency that will make the present day internal combustion engine look like the "one hoss shay" of yesterday.

On Another Trail

I noticed the other day an item in some newspaper to the effect that a very learned man in Europe had suggested that all scientists take a 10-year vacation until the world caught up and learned how to make proper use of the discoveries they have made to date. We know it is impossible to stay the hand of progress but, in so far as the petroleum industry is concerned, why make all the progress in our ability to find, produce and manufacture petroleum. Why not direct some of our scientific effort, for a while at least, to the very urgent problem of more scientific merchandising. In other words, let's bring the selling end of our business up to date.

There is no reason in the world why the petroleum industry should not bend every effort to introduce the use of petroleum in many directions now unknown to us as a possible outlet. There is no use to which petroleum will ever be put that can be classed as wasteful in comparison with the waste accompanying the situation we have today, with production so far in excess of consumption. We are suffering from too much efficiency in every branch of the industry except sales. We know well how to find oil; we know well how to produce it; we know well how to manufacture it into various products but we know too little about the uses to which the products should be put and their value as energy producing agents. We get our merchandise all wrapped up in a beautiful package, tied with a blue ribbon, etc., and





The One is Built Upon the Other

THERE is no business which can prosper by itself alone. Progress comes when industries build each other up through each doing well his particular kind of work and keeping men and materials on tap for the demands that arise.

The utility has power and light on tap for the oil man, but uses oil and oil products in large quantities. The oil man uses every conceivable product, and in turn every industry and every individual is a prospective customer.

Here, in the Southwest, a number of big businesses have grown to full size through the parallel success of other industries all around them. It is a development that is now going on right before us.

Wyatts, devoted to supplying industries with fabricated metal, has been able to build and expand through the equal success of the oil and refining companies, the utilities, the general manufacturers, the builders and the people's own public improvements.

And, in turn, the equipment, experience and consuming power of the Wyatt organization has had its share in aiding industries in the section to keep the upward stride.

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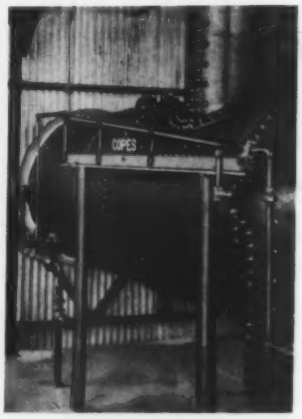

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then the scramble begins. We seem to vie with one another to see who can sell the package at the most ridiculous price—costs considered. In many cases we even give the package away, blue ribbon and all. We get all dressed up with no place to go.

We cannot blame the public for thinking gasoline should be even cheaper than it is today when we are all breaking our necks to get business away from our competitor at a price below what our competitor is charging. Practically every ounce of sales energy today is directed toward taking business away from a competitor, either through knocking his product or cutting his price, rather than in developing new outlets. We cannot expect the public to believe us when we say we are losing money at the price we are willing to accept for our product. I do not believe the public yet has such a poor opinion of the business ability of this industry. We belong to a fraternity of the greatest philanthropists in the world, giving away millions of dollars every day, and when we get it all given away we will go to the poor house. The public will not even thank us.

Wrong Publicity

We are suffering from a lack of publicity of the right kind and an overdose of publicity of the wrong kind. We lay too much stress on the magnitude of our industry and the gushers we bring in. Individually our secret ambition seems to be to bask in the sunshine of a sensational gusher, regardless of whether the property ever pays out or not. There does not seem to be any headline material in making a success of our business from a financial standpoint. Our measure of achievement is volume of business rather than volume of profits. We would rather see the oil going over the crown block than the money going into the till. The roar of the gusher drowns out the click of the cash register. Our publicity is too sensational and gives the public a bad impression. Would we not be better off if we advertised our dry holes and our gasoline plants and refineries that are today either shut down or operating at half capacity? Built of necessity to take care of flush production and now no longer needed. To the public, the oil business consists of punching holes in the ground and bringing in gusher production yielding unconscionable profits at little or no expense. Are we not responsible for this condition? Have we not painted the picture ourselves?

There will be a lot of legislation proposed during the coming session of congress for the regulation of the oil business and, if we continue in the present direction, we might as well admit that we need to be saved from ourselves. There is a law on our statute books making it a felony for a person to make an attempt on his own life. Maybe this session of congress will make it a crime for the petroleum industry to cut its own throat. In some directions government assistance would be helpful but most surely the industry must, in the main solve its own problem, and the solution can be reached through the development of new and ad-

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ditional markets, with some curtailment of production, until the results of any such movement can be made effective. Think of it, an industry with a background of industrial achievement second to none. The industrial world surely is envious of the record of this industry in the recent war and now we are probably going to be told that we do not know how to run our business. If we flee to government for assistance now we are just simply following the line of least resistance and no one can even approximate the ultimate result. Let's quit so much crying about overproduction and get out and sell petroleum products for some new uses. We are in a rut. Gasoline to us is motor fuel and that's about all. How do we know that science can make the most wonderful cough syrup in the world out of it, and that babies can be made to cry for it. Let's at least find out. I do not know who discovered that gasoline would take a gravy spot off of a vest, or that it could be used to good advantage in manufacturing rubber products, or that naphtha was a good ingredient for paint, but I will gamble they were not oil men. Even the Iowa Poland China smiles his gratitude to the rugged swain as he receives his "hog oil" bath because he knows the swain and not the oil fraternity discovered the virtues of this soothing balm. I submit for your consideration this thought: That until we have developed every bona-fide conservative use to which petroleum products can be adapted and have supplied the demand thereby created, we are not justified in locking up the supply. This generation is entitled to the fullest possible benefit from the natural resources of this generation. But I must admit in the same breath, that since we have done so little in developing useful application we most surely need more orderly production today.

Foreign Market Down

The United States has for a long time produced more than 70 per cent of the world's supply of petroleum, but the scenes are changing. Production possibilities in other parts of the world are practically unknown. Certain South American countries, Persia, Russia and Dutch East Indies, bid fair to produce an ever increasing percentage of the world's petroleum. Much of this production is owned by companies controlled in other countries and it seems altogether probable that the program of refinery enlargement now under way in some of those countries will be continued. In other words, it does not seem reasonable that foreign companies will sell their crude oil produced in a foreign country, to an American refiner and then buy gasoline for consumption at home. We say the export business has been "shot" this year. Well it is going to stay shot for some time. During the calendar year 1926, our gasoline exports increased 37.5 per cent over 1925 and 206 per cent over 1922, an average of over 26 per cent every year for four years, but for the first seven months of this year we actually exported less gasoline than we exported

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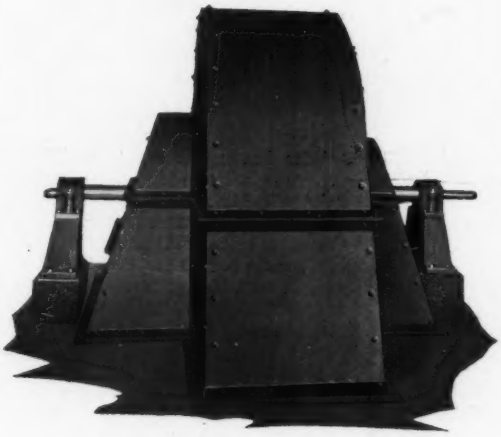

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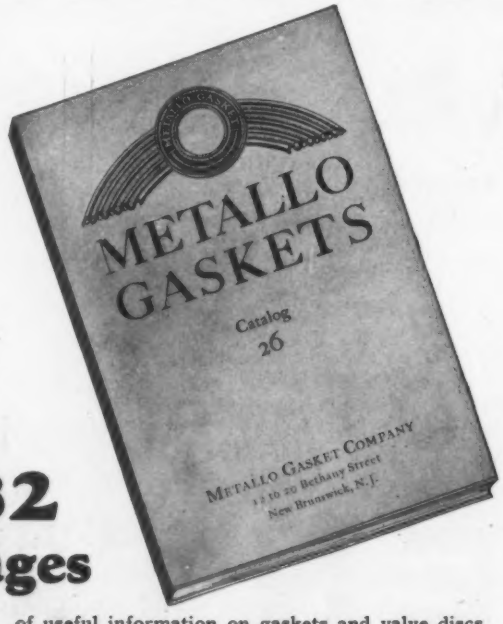

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during the same period last year. If our exports for the whole of this year increase two per cent over 1926, we will be fortunate and this does not mean that there are fewer automobiles in service in foreign countries. It simply means that we are being called upon to supply less of the motor fuel for those countries. It is being manufactured at home. No foreign power is unmindful of the prestige and political security guaranteed by an ample supply of petroleum and the progressive nations of the world are, quite naturally, doing everything in their power to develop a supply independent of the United States. I firmly believe our export business is on the wane. If that be true, is it not another reason why we should bend every effort toward the establishment of new and wider markets at home?

Who knows the exact possibilities of producing motor fuel from coal or alcohol? Who knows but that tomorrow we will read an announcement of the perfection of a process capable of manufacturing a superior motor fuel for half the present cost of gasoline. Just because it has not been done is no reason that it will not be done and we are whistling in the graveyard to still our fears when we scoff at gasoline substitutes. I say again, nothing is impossible now.

Stress on Selling

It seems high time that this industry devoted more thought and scientific effor to the merchandising of its products. You do not expect to be paid for the cost of an oil well or a refinery or a gasoline plant or a filling station except through the sale of the product you produce and is it not true then, that the sales end of your business should be considered of prime importance.

Every individual or company interested directly or indirectly in the petroleum industry could well afford to contribute to a research program designed to develop new and additional markets and, if everyone did contribute, the pro rata cost would be exceedingly small. No one man, no one company, be the scope of its operations ever so wide, can do the job alone. It is a task for the entire industry working through a collective effort representing every branch and therefore, every product of our manufacture. It cannot be done in a day, but a small fraction of the losses sustained by this industry this year, through overproduction and lack of marketing policy, had it been directed toward the development of entirely new markets would surely have brought some results and any results thus obtained would have been of lasting benefit. A dead loss would have been converted to an everlasting asset. Turn the scientists of this country loose and I warrant you that in a very short time they will have the industry oversold. Any product capable of producing the energy that a given unit of petroleum will produce, certainly can be put to many uses unknown to us now. Wherever

(Continued on page 108)

Burns and How to Treat Them*

By Dr. B. A. SWINNEY

BURNS of all kinds occur in refineries and natural gasoline plants the most common being slight, usually from contact with hot metal. Most severe burns are from hot steam and gas burns. Scalds are probably more serious than any other burns we have, however, electrical burns are deeper, slower in healing and produce more scar tissue. Scalds are more extensive, also burns from gas ignition, as the clothing usually catches fire, which produces more burned tissue before being removed, but as a rule, is not so deep and heals more rapidly.

Burns are classified as of first, second or third degree, according to the depth of tissue involvement; first degree being those simply producing a hyperemia; second degree being where the epidermis is lifted, forming blisters, and third, where the deeper tissues are involved. To these should be added a fourth degree burn, as the third degree covers too much territory and does not adequately allow a clear conception of the depth of involvement. Fourth degree should only include burns where a necrosis will occur. All burns except those of first degree should from their very inception be treated as surgical conditions.

It has been stated that burns involving one-tenth of the body surface are serious, and that those involving one-third are often fatal, while those involving two-thirds are almost always fatal. Several facts, however, must be taken into consideration in making an early prognosis (which it is best not to make, but a surgeon is often compelled to do so.) The type of individual, the causation of the burn, the extent as well as the early blood and urine pictures, are factors which lend aid. Unless death occurs in the first 24 hours there is usually hope, although the recovery may be gradual.

Treatment

Minor burns are best treated by first cleansing, or removing foreign material, then applying a temporary dressing of a paste made of soda, or applying a small amount of ungentine before the patient is seen by the surgeon. These burns are later treated with picric acid solution or ointment and, as these begin to dry up, a zinc stearate powder is used which has a tendency to dry the area and hasten healing. First aid in serious burns is a matter of great importance. The patient should be covered well with hot applications if in the winter (to retain body heat) and in the summer cold applications are applied. He should be placed in a closed conveyance and taken to the hospital at once, as the wind irritates and causes added pain. It is never out of place to give a patient a full dose of paregoric or some form of opium, if this is available, at the time or immediately after the patient is burned.

Primary shock is a frequent cause of death; often the patient never rallies, but succumbs before any other direct effect could be expected. This being true, first attention should be devoted to combating shock and not adding thereto. If the pulse is weak a hypodermic of caffeine citrate is given.

One of the best treatments for all types of burns is picric acid solution in 1 per cent solution on gauze dressing, the gauze being constantly moist; it alleviates the pain and at the same time is antiseptic to such a degree that it prevents secondary infection. I have never seen a case of picric acid poisoning, and the objection incident to the pain caused by the removal of the dressings can be overcome by keeping dressings moist and thoroughly soaking before removal. Ambrine of paraffin spray treatment is of great value in extensive burns, prevents scar formation and gives immediate ease in most cases. If infection occurs, it should be discontinued, as it forms a covering for the infections.

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*Before meeting of employes of Chestnut & Smith Corporation, Breckenridge, Texas, September 28, 1927.

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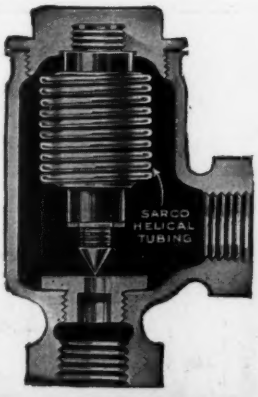

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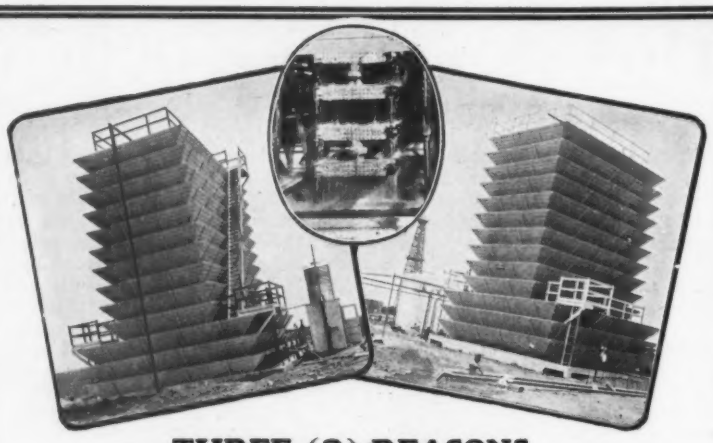

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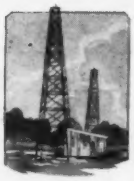
painful body burns, especially those of the back, as the patient needs no dressing, simply lying with the burned areas exposed, the electric light supplying the lost body heat and at the same time drying the burned areas, thus preventing crust formation and promoting healing. This is an ideal method of treatment in extensive burns, as the patient secures more comfort, not being subjected to the pain of dressings, as it is only necessary to change sterile sheets as they become soiled. In addition to this, there is very little scar formation, as infection rarely develops. In case there are infected areas these should be cleansed with boric or salt solution, and either mercurochrome 2 per cent, or argyrol 5 per cent, painted on the infected areas.

Burns which have become infected are very dangerous; in fact, if the patient survives the first 24 hours, infection is the chief cause of death. In severe burns there is usually a flare up the second or third day, due probably to decomposition products being absorbed through the blood. The temperature, pulse and respiration all rise; there is increased restlessness, or on the other hand, there is increased drowsiness with stupor. The patient has ups and downs as long as sloughing of tissue takes place, which is not quickly cleaned up; these areas should receive immediate attention. The slough should be removed by debridement. The parts should be washed with normal salt solution, after which they are gently dried and dichloramin T, 2 to 5 per cent, applied, which is very effective in eliminating infection.

The location of burns plays an important part in the treatment instituted, as it is advisable to prevent scar tissue, which is not only unsightly but also often occurs at such points as to prevent free use of the parts. This is especially true of the neck and arm-pit. Frequently, a little attention paid to the position of these parts, with judicious early strapping, can overcome this tendency. Burns of the hand frequently develop web fingers; adhesive strips placed between the fingers will often prevent this, thereby avoiding late plastic operations which otherwise become necessary. Burns covering a broad area should be strapped early, using strips one-eighth-inch in width, with cross-strapping which forms small openings to allow exudation. These strips can be removed as often as necessary, but it is best to change them as little as possible. The outer dressing of gauze, however, should be changed daily as long as there is free serous exudation; this does not interfere with the straps.

There is no standard treatment for burns. Each case should be treated individually, using the method most suitable for the particular type of burn of the stage to which the burn has progressed, and always attempting to use a treatment which is efficient but at the same time the least painful to apply and to withstand.

The mental attitude of the patient should receive due consideration, for these patients need boosting at every turn, as they have a tendency to become despondent.



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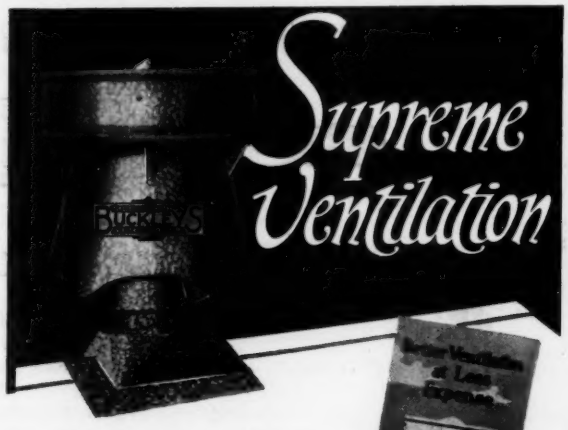

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which gives you full details as to construction, theory, material, capacities, weights and prices.

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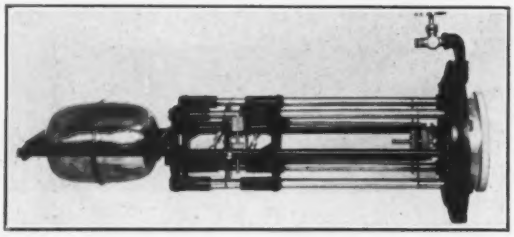

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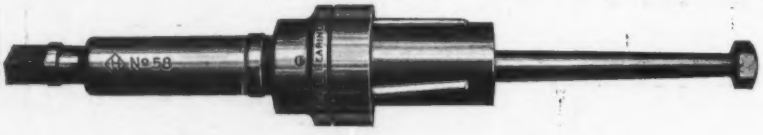

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Hydraulic Pressure Pumps, 8000 pounds
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Flaring Tools for Still Tubes
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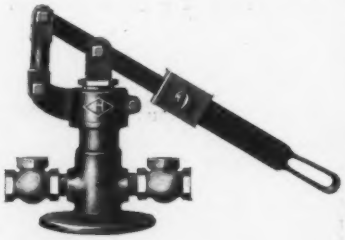

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NEW EQUIPMENT, CATALOGS, BULLETINS, BOOKS

Pyro Optical Pyrometer

PYROMETER INSTRUMENT COMPANY

The Pyrometer Instrument Company, 74 Reade Street, New York, announces a new simplified pyro optical pyrometer.

The pyrometer is self contained and incorporates all parts necessary for accurate temperature readings in one small unit. Pyro is used like a telescope; it magnifies the object four times its actual size. The object itself appears in its actual colors. The light rays of the object to be measured are concentrated through the objective, in such a way that they are thrown on the plane of the system of prisms and are clearly seen through the eyepiece.

The plane has a small transparent test mark, which appears to the eye as a small clear cut elliptical ring. This ring is lighted by a tiny electric lamp by pressing a contact button. The lamp receives current from a common dry cell battery.

The small elliptical ring in the range of vision, which at a distance of about 40 feet covers an area of a nickel, represents the standard brightness, burning with constant intensity by which the light of the observed body is compared.

All to be done is to sight the instrument in such a way that the testmark covers the object to be measured, and to adjust the brightness of the range of vision until the test mark disappears. For this purpose a circular color filter has been inserted with graduating density of color. This is rotated by the adjusting band and filters the color of the object until the brightness of the test mark is matched. The temperature is then indicated on the scale.

Since all optical pyrometers work on monochromatic light after sighting, it is necessary to insert the red glass by pushing the switch below the eyepiece, before measuring the temperature.

Further information regarding the pyrometer will be gladly supplied by the company, on request.

Specific Gravity Balance

THE REFINERY SUPPLY COMPANY

The Refinery Supply Company, Fourth and Detroit, Tulsa, and 917 Santa Fe Building, Dallas, Texas, announces the K. S. Precision Specific Gravity Gas Balance.

The outfit consists of a balance beam carrying a sealed globe on one end and a counter-weight on the other. The balance beam with its support is mounted in a gas-tight chamber. The chamber is closed at one end with a metal cap, which is fitted with glass so as to permit observation of the balance beam indicator.

Further information will be supplied by the company, on request.

PYROMETER PYROMETER

New Tower Packing

ISOLANTITE COMPANY OF AMERICA

Isolantite Company of America, Belleville, New Jersey, is announcing a new chemical tower packing known as Isolantite rings.

Isolantite has its beginnings in a mineral product which is pulverized to such a degree that it is said to float in air. It is practically semi-collodial. The mineral product is chemically purified and when so, the resultant powder contains no organic matter and no plastic material.

The powder is subjected to enormous pressure in hydraulic presses in order to form blocks or billets. The billets are then forged or extruded to desired shape, and can be further formed by the usual metal machining methods. The material offers the chemical engineer features common to metals and ceramics.

The formed material is finally heat treated. Prior to firing or heat treatment, Isolantite in the raw may be machined with the precision and ease of metal. It may be threaded, milled, drilled or forged. It may be extruded in the most delicate shapes. However, following the firing or heat treatment, Isolantite is converted into a rock-hard material which cannot be altered.

A few applications of the material in the chemical field include: valves, acid spray nozzles, baffle plates, jets, crucibles, tower filler, distillation column packing, short piping, pyrometer tubes and laboratory apparatus.

Further information can be obtained on request from the company.

New Automatic Switch

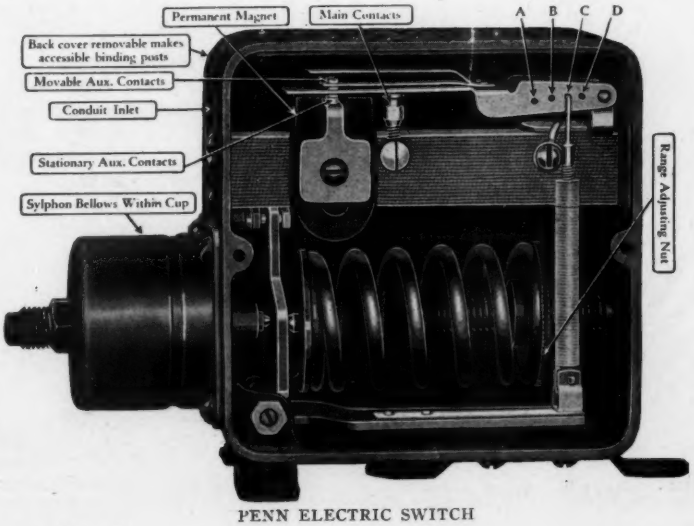
PENN ELECTRIC SWITCH COMPANY

The Penn Electric Switch Company, Des Moines, Iowa, is putting on the market a magnet switch for temperature, pressure, or vacuum service.

The switch can be furnished to either open or close an electric circuit, as may be required with a change of pressure, vacuum or temperature.

One type, L, is offered for applications where extremely close differential is required between start and stop positions. The differential on temperature can be varied from a minimum of two degrees to a maximum of eight degrees. When furnished as a pressure switch, the differential can be varied for a minimum of one pound to a miximum of five pounds.

Patented contact construction used in the switch consists of a permanent magnet



PENN ELECTRIC SWITCH

working in conjunction with a movable armature, which in turn, is actuated by means of a sylphon bellows. A lost motion at the contacts insures that each opening of the circuit will be with a snap action, and the action of the magnet on closing, insures positive snap movement during that cycle of the operation. The auxiliary contacts are made of silver and are located directly between the poles of the permanent magnet. The blow-out effect of the magnet makes it possible to break extremely heavy currents instantly.

Additional information will be furnished on request.

Chemicals Booklet

The Mathieson Alkali Works, Inc., 250 Park Avenue, New York, announces a new bulletin, No. 271, called "Chemicals for the Petroleum Industry."

In this bulletin there is a comprehensive discussion of the Mathieson Hypochlorite process for the refining of petroleum distillates, together with detailed sketches illustrating plant lay-outs for batch and continuous treating and for the several approved methods of preparing hypochlorite solutions.

Other subjects covered include the arresting of corrosion in refinery equipment and the use of alkalies in oil well flooding operations.

Copies of the bulletin will be mailed on request.

Specification Bulletin

Large-scale users of gasoline, illuminating oils, fuel oils and lubricating oils and greases will be interested in the publication by the United States Bureau of Mines, Department of Commerce, of Technical Paper 323B, "United States Government Master Specification for Lubricants and Liquid Fuels and Methods for Sampling and Testing." This specification, the present revision of which was effective October 21, 1927, was officially adopted by the Federal Specifications Board on February 3, 1922, for the use of the departments and independent establishments of the government in the purchase of materials covered by it. The latest date on which the present revision of this specification shall become mandatory for all departments and independent establishments of the government is January 21, 1928. The specification may be put into effect, however, at and earlier date.

Technical Paper 323B contains specifications for both fighting and domestic grades of aviation gasoline, United States government motor gasoline, kerosene, longtime burning oil, 300 degree mineral seal oil, navy standard fuel oil, bunker fuel oil, car and locomotive engine oil, Diesel engine lubricating oil, gear, chain, and wire rope lubricant, transmission oil, marine engine oil, steam cylinder oil, aircraft machine gun oil, mineral lubricating grease, graphite lubricating grease, cutting oil, lard oil, etc. Methods for testing these various lubricants and liquid fuels are also given in detail, together with methods for sampling petroleum and petroleum products. The testing methods described cover such matters as color, viscosity, penetration of greases, determination of flash point, flock test, burning test, water content, emulsion test, sulphur content, etc.

Copies of Bureau of Mines Technical Paper 323B may be purchased from the Superintendent of Documents, Government Printing Office, Washington, D. C., at a price of 15 cents.

Feed Water Heaters

Elliott Company, Jeannette, Pennsylvania, announces the publication of Bulletin D-2, on feed water heaters.

The bulletin covers 34 pages, is printed in two colors, and is profusely illustrated. It covers open heaters, deaerating heaters, and closed heaters, with a complete discussion of construction features and details of design.

Copies of the bulletin may be had upon request to the Elliott Company, Jeannette, Pennsylvania, or to any Elliott district office.

Stockham steel fittings for superheated steam, high pressures and high temperatures, are described in a catalog issued by the Stockham Pipe & Fittings Company, this month. This company devotes its energy and resources to the manufacture of cast iron and malleable pipe fittings exclusively.

Mention Where You Saw the Advertisement

OIL METERS *for* CRACKING PROCESSES

The EMPIRE Made to withstand working pressures of 300 pounds to the square inch. Special types can be furnished for higher pressures if required. Standard models for general use will sustain a working pressure of 150 pounds. Sizes range from ⅝ inch to six inches, and are supplied either with clock-like vertical dial, or a horizontally placed straight reading register.
The EMPIRE is a positive displacement meter, operated by an *oscillating* piston. It is accurate, and *stays* accurate.

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Give us an opportunity to figure on your next printing job

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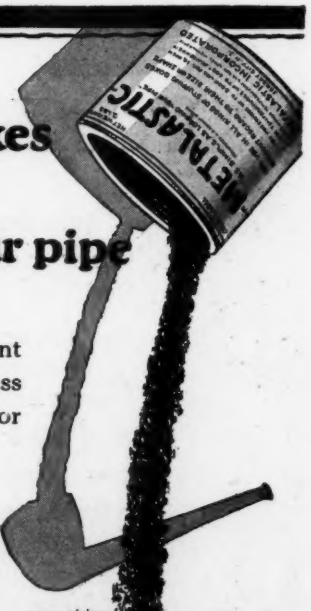

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Our Equipment is in First Class Mechanical Condition

Cars for Gasoline, Fuel Oil, Lubricating Oils
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Magnolia Bldg. DALLAS, TEXAS (*Write or Wire Our Nearest Office*) Oliver Bldg. PITTSBURGH, PA.

For Protection

When paint spraying outside work use the New Improved Pulmosan Dustproof Aluminum Respirator.

For painting inside of tanks and tank cars use the Pulmosan Airline Mask with blower attachment.

Write for Descriptive Literature

Pulmosan Safety Equipment Corp.

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Selling Cure for Over Production

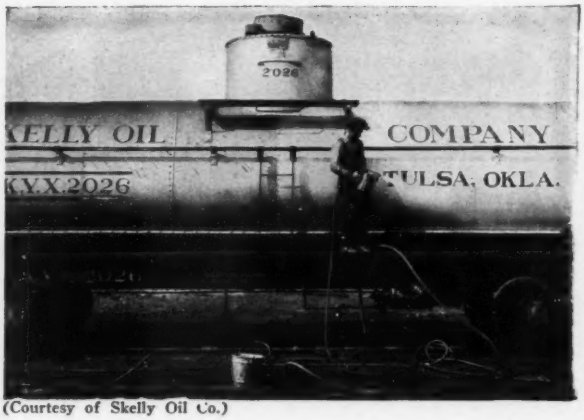
(Continued from page 100)

oil men gather today, new and improved methods of production is the topic of conversation. The engineering department of every oil company in the world is burning midnight oil (or electricity rather, we have just about lost that market) studying the problem of more efficient extraction of oil from producing formations, and this intense effort is bearing fruit. We are doing that part of the job more efficiently and more economically every day. The new methods will save us money over the old, but just as sure as the world we will give it away when it comes time to sell the product. The entire thought of the industry seems to be concerned with the production of more oil. I cast no reflections on the sales department of any company. They have done very well under the circumstances. Millions are spent every day to get more oil when we don't need it. Would not some of the money be better spent creating a market for the oil we have? A new filling station across the street from a competitor does not sell one additional gallon of gasoline.

The present scientific research program of the American Petroleum Institute is most commendable but its scope is not wide enough. The results obtained will be to teach us how better to find deposits of petroleum and how to manufacture them into finished products more efficiently and with less expense. This is all very fine if we know what to do with the products when we get them. This industry has been for years under the necessity of developing the science of producing and manufacturing petroleum to the last degree of efficiency because of the tremendous demand that has been forced upon it but we have reached the place now, in fact we reached it two or three years ago, where we are not going to have handed to us a market that will readily absorb the products we so efficiently produce, and I do not believe the present condition is temporary. In a few months, no doubt, we will be talking shortage but we ought to know, by this time, that that condition will be temporary.

Little But Profitable

In this connection, I think of the electric industry. We see them fostering and promoting, through tremendous advertising campaigns, a little old curling iron or some other electric appliance, that in itself, probably does not consume as much electricity as would be required to illuminate a lightning bug. But most surely we would be surprised if we knew the amount of electricity consumed by all the electrical devices that the electrical industry itself has developed, in order that we might have more personal comfort and, incidentally, buy more electricity. We have been taught to think in terms of millions of barrels but from now on we must adjust our sights so fine that we will



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THE easiest—and cheapest—way to clean tank cars, storage tanks, and trucks painted aluminum white or in other colors that show dirt easily, is to wash them regularly with Oakite. Soot, oil, gasoline and dirt are quickly removed and the original color of surface is restored without injury to the paint.

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Get complete information about these money-saving cleaning methods. Send for a copy of our booklet "Oakite in the Oil Industry" and read over the valuable suggestions contained in it. Write today—no obligation.

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Oakite Service Men, cleaning specialists, are located at

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Low, dry temperatures, WHEN and WHERE you want them! In your processes or in your storages, adequate refrigeration is essential.

YORK Absorption Refrigerating machines are built in either the double pipe, atmospheric, or shell and tube types, and consist principally of the following parts:

Generator,
Analyzer,
Dehydrator,
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Weak Aqua Cooler,
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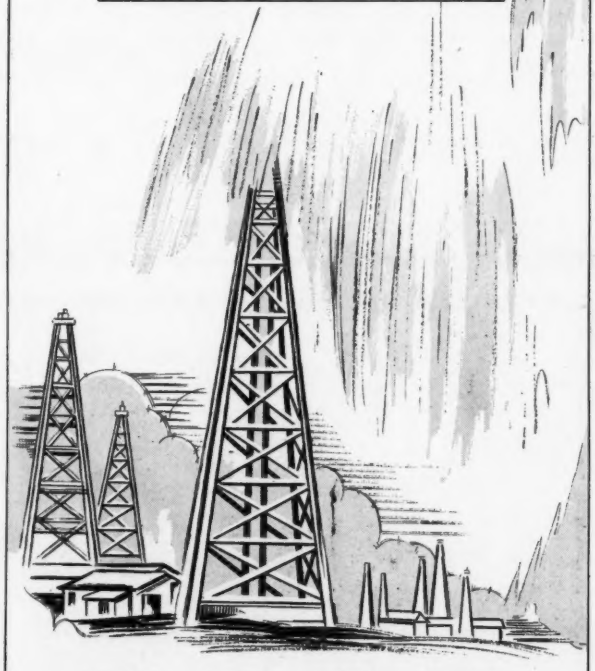
Write for particulars on YORK refinery refrigeration.



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ICE MACHINERY CORPORATION
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YORK ICE MACHINERY CORPORATION,
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Without obligation on my part, please send me full particulars regarding your equipment for refinery refrigeration.

Name.....

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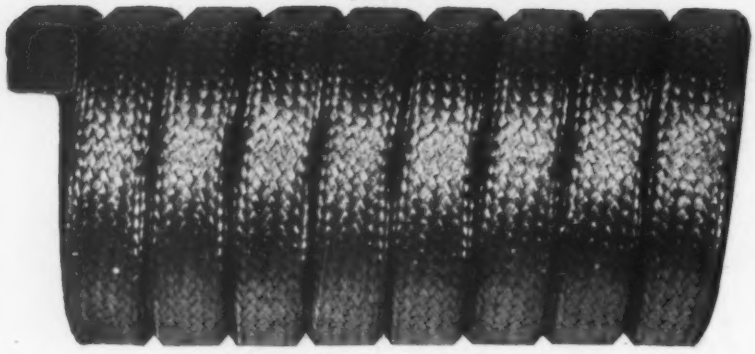
"John Crane"



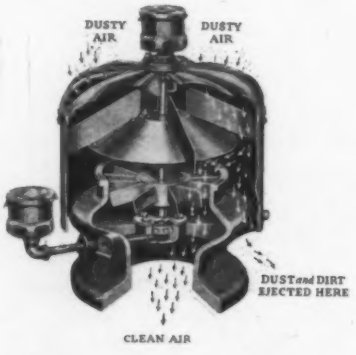
Craneum for Gas Lift Compressors

Many refinery superintendents have been surprised at the long trouble-free service of "John Crane" Style 250 on gas lift compressors, centrifugal pumps handling crudes, oils or distillates and on hot oil plunger pumps. Temperature to 1,500°F. Pressures to 2,000 lbs. Made of Craneum, the ideal mixture of metal particles, high temperature materials, graphite and binder in a braided copper jacket.

Where asbestos packing gave brief and uncertain service, "John Crane" Style 250 in some cases has lasted *twelve times* as long. It runs without wear or friction on rods or shafts—no smoke, no leakage.

Order now through your jobber or direct.

CRANE PACKING CO., 1808 Cuyler Ave., Chicago, Ill.



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will help solve your engine troubles. Operated automatically by suction of engine. Eliminates dust and dirt, reduces carbon deposits and enhances engine efficiency. Increases engine life. There is a size of Cleaner for every requirement. For specifications and prices, address

Maintenance Engineering Corporation

W. J. Peddie, Pres. P. O. Box, 1402 Phone, Preston 5580 L. J. Burda, Secy-Treas.

Houston, Texas

be able to see every possible additional use, be the quantity required ever so small.

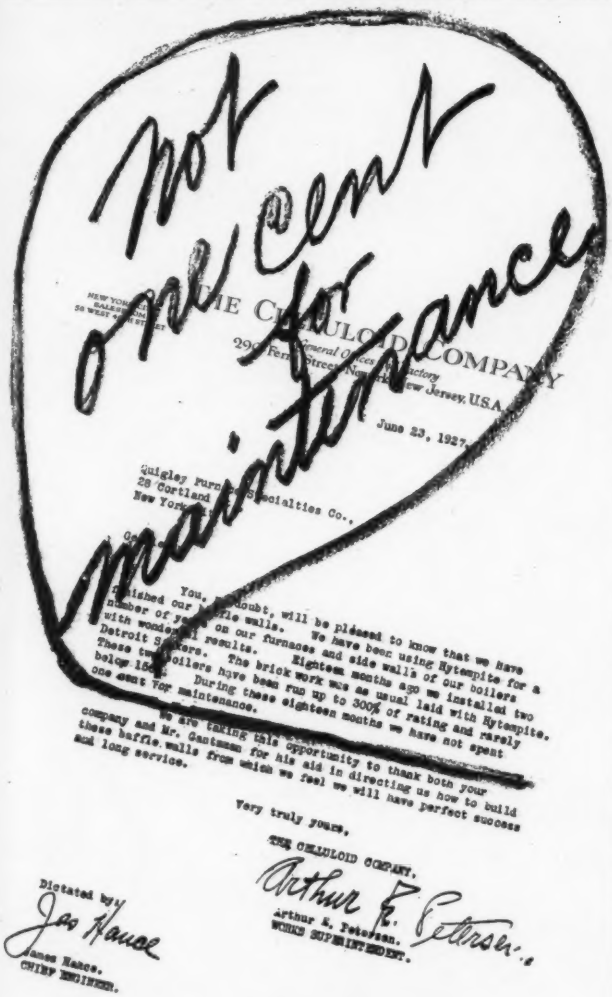
The achievements of the cement industry in this direction must convince us of the possibilities. That industry has organized a corporation whose business it is to develop and faster markets for cement products. Who should have thought 15 years ago of constructing a 20-story building out of concrete? They all had to be steel but now you see all over the country skyscrapers constructed of cement. Something else to think about—do you suppose the cement industry has been sitting back with its hands folded while states, counties and municipalities have been covering them up with orders for cement for the construction of paved highways?

It is said that there are in use today approximately 700,000 oil burners in homes and that these burners will consume something like 45,000,000 barrels of distillate this coming season. I believe, had the petroleum industry, as a whole, supported the burner industry two or three years ago as the electrical or cement industries most certainly would have done had the matter been one of equal concern to them, there would be twice as many burners now in service. This outlet for 45,000,000 barrels of petroleum this year developed in spite of us. We did our best to frighten it away. We practically turned a cold shoulder because we were afraid of a shortage of petroleum and consequent higher prices later on. Had the automotive industry followed our line of reasoning, they should have discontinued manufacturing motor cars two or three times in the past 10 years. A comparison of the increase in value of automotive securities as against oil securities renders comment as to the wisdom of their policy unnecessary. First, we think we see a shortage in the offing and before we can turn around we are drowning in overproduction.

Surely public confidence in the industry must be shaken by so much alternating, feast and famine publicity. It starts the automotive engineer wondering how he can increase gasoline mileage. It scares the railroads back to coal for fuel and it scares the public away from oil burners. This eternal fear of a shortage tomorrow has done irreparable damage.

J. M. Lawrence, who has been connected with the Maintenance Engineering Corporation, Houston, has severed his connection with this firm, and effective November 1, will take up duties with C. E. Naylor, 810 Esperson building, Houston, to assist him in matters pertaining to his railway and refinery supplies.

C. J. Foulston, who has been in charge of the natural gas and gasoline work for Roxana Petroleum Corporation, in the Texas Panhandle, has been given charge of that work for the Roxana in Mexico, with headquarters in Tampico.


Not one cent for maintenance
THE CELLULOID COMPANY
June 23, 1927.
Quigley Furnace Specialties Co.,
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You, no doubt, will be pleased to know that we have
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with wonderful results on our furnaces and side walls of our boilers
Detroit Stoker.
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below 15
one cent for maintenance.
During these eighteen months we have not spent
company and Mr. Gantzman for his aid in directing us how to build
these baffle walls from which we feel we will have perfect success
and long service.
Very truly yours,
THE CELLULOID COMPANY,
Arthur K. Petersen.
WORKS SUPERINTENDENT.
Dictated by
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HYTEMPITE

Highly Recommended

Because it gives entire satisfaction both for laying up fire brick and for building monolithic baffles. Maintenance costs are practically eliminated.

Hytempite is a plastic refractory material, scientifically compounded for bonding fire brick, building monolithic baffles and walls, making special shapes and for general repair work.

Use Hytempite and you will be able to say, "Not one cent for maintenance"

Quigley Furnace Specialties Co., Inc.
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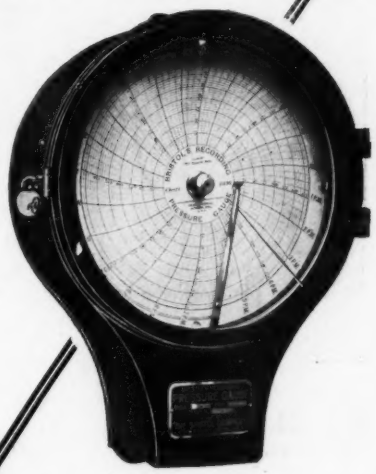
Quick Service from Stock in Every Industrial Center

After 30 Years of Continuous Service

1897–1927

Without Requiring Repairs



Bristol's Recording Pressure Gauge

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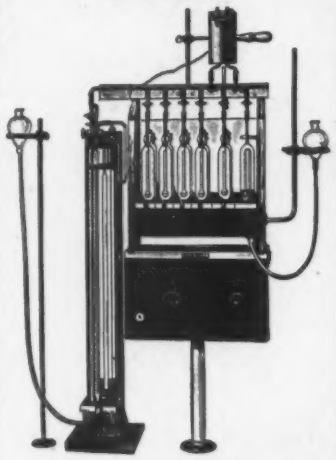
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California Association Announces Fall Convention Program

Los Angeles, Cal.—The tentative program for the fall meeting of the California Natural Gasoline Association, was released at the October monthly meeting of the organization, October 20. The chief attraction to the program is the appearance of Dr. G. G. Brown, director of research for the Association of Natural Gasoline Manufacturers and a professor of chemical engineering in the University of Michigan.

The program will consist of technical and semi-technical papers, with discussions. Dr. Brown will present the subject, "Importance of Natural Gasoline as a Constituent of Motor Fuel." He will appear through the courtesy of the Association of Natural Gasoline Manufacturers, for which he has made the investigations that have developed his subject.

Morning Session — Tuesday, November 15, 1927

8:00 a. m.-9:30 a. m.—Registration.
9:30 a. m.—Address of welcome.
9:45 a. m.—President's address.
10:00 a. m.—Paper: "Proposed Tentative Standard Pressure Charcoal Test for Gasoline Content of Natural Gas."

Paper to be prepared by the "Gas Testing Committee" of the association and to be a summary of their recommendations. To be presented by P. S. Magruder, General Petroleum Corporation of California, sub-chairman of committee.

Discussion.

11:00 a. m.—Paper: "Classification of the Various Grades of Natural Gasoline Produced in California."

Paper to be prepared by the "Specifications Committee" of the association and presented by R. W. Garman, Union Oil Company, chairman of committee.

Discussion.

11:30 a. m.—Paper: "Recommendations for Standardization of Barometric Pressure in Natural Gas Measurement."

Paper to be prepared in conjunction with the "Metering Committee' of the association and presented by Ben Laulbere, Midway Gas Company.

12:00 m.-1:30 p. m.—Recess for luncheon.

Afternoon Session.

1:30 p. m.—Paper: "The Determination of the Vapor Tension of Volatile Liquids—Comparison of Method Proposed by C. P. Beistle of the Bureau of Explosives with Present Bureau of Explosives Standard Test for Gasolines."

Presented by C. D. Gard, Union Oil Company.

Discussion.

2:30 p. m.—Paper: "Analytical Gas and Gasoline Fractionation."

Presented by L. O. Warner, Barton, Manning & Warner.

Discussion.

3:15 p. m.—Paper: "Safety and Fire Prevention in Gasoline Plants."

Presented by H. N. Blakeslee, field secretary National Safety Council.

Discussion.

4:00 p. m.—Paper: "Production of Natural Gasoline by Conservation of Vapors."

Presented by W. G. Palmer, J. A. Campbell Company.

Discussion.

5:00 p. m.—Adjournment.

Morning Session, Wednesday, November 16, 1927.

9:30 a. m.—Address: "Importance of Natural Gasoline As a Constituent of Motor Fuel."

Presented by Dr. G. G. Brown, professor of chemistry, University of Michigan. Director of Research for the Association of Natural Gasoline Manufacturers.

Through the courtesy of the Association of Natural Gasoline Manufacturers Dr. Brown will present data accumulated in connection with the last two years' research program sponsored by that association.

12:00 noon—Adjournment for luncheon.

Afternoon Session.

1:30 p. m.—Continuation of Dr. Brown's address.

Discussion.

4:30 p. m.—Adjournment.

Evening Session.

7:00 p. m.—Banquet and entertainment for members and visitors. A few short addresses will be made—speakers and toastmasters to be announced later.

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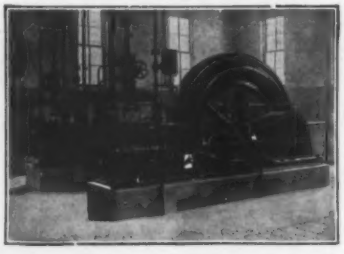
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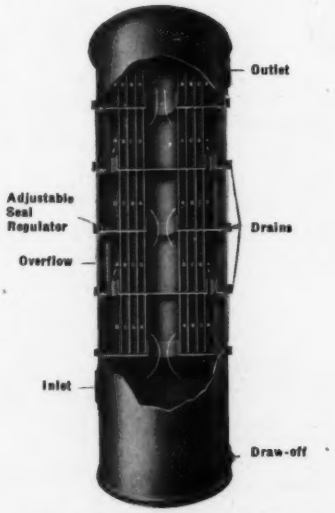

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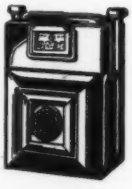

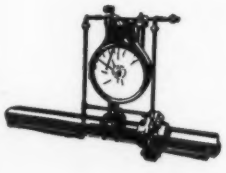

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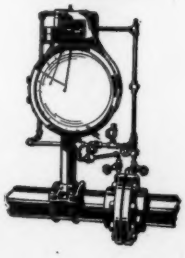

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